

## CONSULTANT REPORT

# ASSESSMENT OF PUBLICLY OWNED UTILITIES' REVISED ENERGY EFFICIENCY POTENTIALS AND TARGETS

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## ABSTRACT

In 2006, the California Legislature passed Assembly Bill 2021 (Levine, Chapter 734, Statutes of 2006) to promote energy efficiency in California's electric and natural gas utilities. This report addresses the legislation's mandate requiring publicly owned utilities to identify all potentially achievable, cost-effective electricity efficiency savings, to establish annual targets for energy efficiency savings and demand reduction for the next 10-year period, and to submit this information to the California Energy Commission for evaluation. This report assesses the energy efficiency potential and efficiency savings targets adopted for 2011–2020 by the publicly owned utilities. This report also assesses the publicly owned utility efficiency savings targets based on cost-effectiveness, achievability (or feasibility), reliability, and capability to reduce energy use. KEMA developed specific criteria to evaluate the method used by the publicly owned utilities for developing the potential estimates and setting the savings targets. The energy use reduction goal laid out in Assembly Bill 2021 is 10 percent of base energy use over 10 years, which closely corresponds to 1 percent per year. While some individual publicly owned utilities project 10 percent savings over 10 years, the aggregated publicly owned utility targets do not meet the Assembly Bill 2021 goal, reaching savings of only 6.8 percent of forecasted 2020 base energy use. KEMA concluded that the California Energy Efficiency Resource Assessment Model used by the publicly owned utilities to estimate energy efficiency potential and set targets is fundamentally sound. The same model should be used in the future for target setting, with specific enhancements to increase transparency of the model inputs and results. The publicly owned utilities should improve documentation of the potential estimates and targets to help the Energy Commission fulfill the requirements of Assembly Bill 2021. Public utilities could increase future efficiency savings and better meet Assembly Bill 2021 goals by increasing energy efficiency programmatic initiatives and customer incentive levels.

**Keywords:** Energy efficiency, energy savings, demand reduction, electricity consumption, natural gas, peak, potential estimates, targets, goals, Assembly Bill 2021, Senate Bill 1037, investor-owned utilities, publicly owned utilities

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# TABLE OF CONTENTS

<b>ABSTRACT .....</b>	<b>i</b>
<b>TABLE OF CONTENTS.....</b>	<b>iv</b>
<b>List of figures .....</b>	<b>vi</b>
<b>EXECUTIVE SUMMARY .....</b>	<b>1</b>
Approach.....	2
Findings .....	3
Recommendations.....	12
<b>CHAPTER 1: Introduction.....</b>	<b>15</b>
Background .....	15
Study Scope and Key Objective .....	16
Organization of the Report .....	18
<b>CHAPTER 2: Information Sources and Framework Used for Assessing Publicly Owned Utilities’ Potentials and Targets .....</b>	<b>19</b>
Objective and Analytical Approach .....	19
Methods and Models Used by the Utilities .....	19
Sources of Potentials and Targets .....	20
Approach for Assessing Utility Potentials and Targets Across All Utilities .....	24
Approach for Assessing 12 of the Larger Utilities.....	25
Individual Utility Results.....	27
<b>CHAPTER 3: Assessing Utility Potentials and Targets Across All Utilities .....</b>	<b>28</b>
Comparison of Potentials and Targets.....	28
A Brief Comparison of LADWP and SMUD .....	49
<b>CHAPTER 4: Assessing 12 of the Larger Utilities.....</b>	<b>53</b>
General Model Structure and Capabilities (Framework 1) .....	53
CalEERAM Model Evaluation Results—POU-Specific Models (Framework 2).....	55
<b>CHAPTER 5: Individual Utility Results—Assessment of Potential Estimates and Energy and Peak Targets for Utilities .....</b>	<b>90</b>

Overarching Issues.....	92
Anaheim .....	94
Burbank .....	106
Glendale.....	117
Imperial Irrigation District.....	130
Modesto .....	141
Palo Alto .....	152
Pasadena.....	163
Riverside.....	176
Roseville .....	189
Silicon Valley Power .....	203
Truckee Donner .....	217
Turlock Irrigation District.....	230
<b>CHAPTER 6: Summary and Recommendations .....</b>	<b>242</b>
Efficiency Potential Model Assessment .....	242
Technical and Economic Efficiency Potential .....	243
Market Efficiency Potential and Targets.....	245
Recommendations.....	246
<b>References.....</b>	<b>249</b>
<b>Attachment A: Assembly Bill 2021 (Levine, Chapter 734, Statutes of 2006) .....</b>	<b>1</b>
<b>APPENDIX A: Results of Recent Potential Studies in the United States and Canada.....</b>	<b>1</b>
<b>APPENDIX B: Evaluation Frameworks .....</b>	<b>1</b>
Framework 1: Framework for Evaluating Energy Efficiency Potential Model Structure and Design .....	1
Framework 2: Framework for Evaluating POU Energy Efficiency Potential Estimates.....	18
Comparison of 2007 and 2010 Energy Savings Potentials and Targets (MWh) .....	46
Comparison of 2007 and 2010 Demand Savings Potentials and Targets (MW).....	50
<b>APPENDIX C: Model Inputs .....</b>	<b>1</b>

## LIST OF FIGURES

Figure 1: Comparison of 2007 Targets to 2010 Targets .....	8
Figure 2: CMUA POU Annual and Cumulative Targets as a Percent of Energy Use.....	9
Figure 3: 10-year Cumulative Targets as Percentage of 2020 Energy Use, Ranked by Utility Energy Use .....	10
Figure 4: Comparison of Cumulative 2011-2020 Market Potential for Different Versions of the CalEERAM Model.....	23
Figure 5: Technical and Economic Potential in 2011 as a Percentage of Energy Use, and Economic Potential as a Percent of Technical, by Utility .....	29
Figure 6: Average Annualized Percentage Change in System Load and in Technical and Economic Potential, 2011-2020 .....	31
Figure 7: Change in Technical Potential From 2007 Estimates to 2010 Estimates (2011 Technical Potential) .....	34
Figure 8: Annual and Cumulative Targets as a Percentage of Energy Use .....	36
Figure 9: 10-Year Cumulative Targets as Percentage of 2020 Energy Use, Ranked by 2011 Utility Energy Use .....	37
Figure 10: Comparison of Targets and Market Potentials, Larger Utilities .....	39
Figure 11: Comparison of Targets and Market Potentials, Smaller Utilities .....	40
Figure 12: Cumulative Utility Targets 2011-2020 as a Percentage of Economic Potential.....	42
Figure 13: Comparison of 2011 Targets Between 2007 Target-Setting Process and 2010 Target- Setting Process .....	44
Figure 14: Comparison of 2011 Target and 2009 Reported Savings, Percentage of Energy Use ..	45
Figure 15: Shares of Base Energy Use and Targets by Utility Group and Size .....	51
Figure 16: Comparison of 2007 Targets to 2010 Targets .....	52
Figure 17: Residential Energy Rates by Utility .....	70
Figure 18: Nonresidential Energy Rates by Utility.....	71
Figure 19: Avoided Costs by Utility and Period.....	73
Figure 20: Technical and Economic Savings in 2011 as a Percentage of Energy Use, by Utility ..	76
Figure 21: Market Potential as a Percentage of Energy Use, 2011-2020 .....	78
Figure 22: Residential and Nonresidential Program Costs per First-Year kWh Saved for Year 5 of Program .....	81
Figure 23: Comparison of Targets and Market Potentials as a Percentage of Energy Use: Anaheim, Glendale, Palo Alto, Pasadena, Silicon Valley Power, and Truckee .....	82
Figure 24: Comparison of Targets and Market Potentials as a Percentage of Energy Use: Burbank, Imperial, Modesto, Riverside, Roseville, and Turlock.....	83
Figure 25: Targets Over Time Relative to Base Year .....	84
Figure 26: Comparison of 2007 and 2010 Estimates of Technical and Economic Potential in 2011 .....	86
Figure 27: Comparison of 2007 and 2010 Energy Reduction Targets for 2011 .....	87

Figure 28: Comparison of 2007 and 2010 Demand Reduction Targets for 2011 .....	88
Figure 29: Technical and Economical Energy Savings Potential (MWh)—Anaheim.....	95
Figure 30: Technical and Economic Demand Savings Potential (MW)—Anaheim.....	96
Figure 31: Target Energy Savings as a Percentage of Economic Savings Potential—Anaheim....	97
Figure 32: Anaheim’s Historical Annual Energy Efficiency Program Savings and Targets .....	98
Figure 33: Anaheim’s Market Savings Potential (MWh) by End Use.....	99
Figure 34: Anaheim’s Market Savings Potential (kW) by End Use.....	100
Figure 35: Anaheim’s TRCs From Two CalEERAM Versions, Compared to Other POUs .....	101
Figure 36: Target Energy Savings as a Percentage of Base Energy Use—Anaheim .....	102
Figure 37: Anaheim’s Targets in Context of 12 of the Largest POUs .....	103
Figure 38: Technical and Economical Energy Savings Potential (MWh)—Burbank.....	107
Figure 39: Technical and Economic Demand Savings Potential (MW)—Burbank.....	108
Figure 40: Target Energy Savings as a Percentage of Economic Savings Potential—Burbank...	109
Figure 41: Burbank’s Historical Annual Energy Efficiency Program Savings and Targets .....	110
Figure 42: Burbank’s Market Savings Potential (MWh) by End Use.....	111
Figure 43: Burbank’s Market Savings Potential (kW) by End Use.....	112
Figure 44: Burbank’s TRC Ratios From Two CalEERAM Versions, Compared to Other POUs	113
Figure 45: Target Energy Savings as a Percentage of Base Energy Use—Burbank .....	114
Figure 46: Burbank’s 10-Year Cumulative Targets, Compared to the Other POUs .....	115
Figure 47: Technical and Economical Energy Savings Potential (MWh)—Glendale .....	118
Figure 48: Technical and Economic Demand Savings Potential (MW)—Glendale .....	119
Figure 49: Target Energy Savings as a Percentage of Economic Savings Potential—Glendale ..	120
Figure 50: Glendale’s Historical Annual Energy Efficiency Program Savings and Targets.....	121
Figure 51: Glendale’s Market Savings Potential (MWh) by End Use .....	122
Figure 52: Glendale’s Market Savings Potential (kW) by End Use.....	123
Figure 53: Glendale’s TRC Ratios From Two CalEERAM Versions, Compared to Other POUs	125
Figure 54: Target Energy Savings as a Percentage of Base Energy Use—Glendale .....	126
Figure 55: Glendale’s 10-Year Cumulative Targets Compared With the Largest POUs .....	127
Figure 56: Technical and Economical Energy Savings Potential (MWh)—Imperial.....	131
Figure 57: Technical and Economic Demand Savings Potential (MW)—Imperial.....	132
Figure 58: Target Energy Savings as a Percentage of Economic Savings Potential—Imperial...	133
Figure 59: Imperial’s Historical Annual Energy Efficiency Program Savings and Targets .....	134
Figure 60: Imperial’s Market Savings Potential (MWh) by End Use.....	135
Figure 61: Imperial’s Market Savings Potential (kW) by End Use.....	136
Figure 62: Imperial’s TRC Ratios From Two Versions of CalEERAM, Compared to Other POUs .....	137
Figure 63: Target Energy Savings as a Percentage of Base Energy Use—Imperial .....	138
Figure 64: Imperial’s Targets in Context of 12 of the Largest POUs.....	139
Figure 65: Technical and Economical Energy Savings Potential (MWh)—Modesto.....	142
Figure 66: Technical and Economic Demand Savings Potential (MW) —Modesto.....	143
Figure 67: Target Energy Savings as a Percentage of Economic Savings Potential—Modesto...	144
Figure 68: Modesto Historical Annual Energy Efficiency Program Savings and Targets.....	145
Figure 69: Modesto’s Market Savings Potential (MWh) by End Use.....	146

Figure 70: Modesto’s Market Savings Potential (kW) by End Use .....	147
Figure 71: Modesto’s TRC Ratios From Two Versions of CalEERAM, Compared to Other POU’s .....	148
Figure 72: Target Energy Savings as a Percentage of Base Energy Use—Modesto.....	149
Figure 73: Modesto’s 10-Year Cumulative Targets Relative to the 12 Largest POU’s.....	150
Figure 74: Technical and Economical Energy Savings Potential (MWh)—Palo Alto.....	153
Figure 75: Technical and Economic Demand Savings Potential (MW)—Palo Alto.....	154
Figure 76: Target Energy Savings as a Percentage of Economic Savings Potential—Palo Alto .	155
Figure 77: Palo Alto’s Historical Annual Energy Efficiency Program Savings and Targets .....	156
Figure 78: Palo Alto’s Market Savings Potential (MWh) by End Use .....	157
Figure 79: Palo Alto’s Market Savings Potential (kW) by End Use .....	158
Figure 80: Palo Alto’s TRC Ratios From Two Versions of CalEERAM, Compared to Other POU’s .....	159
Figure 81: Target Energy Savings as a Percentage of Base Energy Use—Palo Alto .....	160
Figure 82: Comparison of Palo Alto’s Targets With the Largest POU’s.....	161
Figure 83: Technical and Economical Energy Savings Potential (MWh)—Pasadena .....	165
Figure 84: Technical and Economic Demand Savings Potential (MW)—Pasadena .....	166
Figure 85: Target Energy Savings as a Percentage of Economic Savings Potential—Pasadena .	167
Figure 86: Pasadena’s Historical Annual Energy Efficiency Program Savings and Targets.....	168
Figure 87: Pasadena’s Market Savings Potential (MWh) by End Use .....	169
Figure 88: Pasadena’s Market Savings Potential (kW) by End Use .....	170
Figure 89: Pasadena’s TRC Ratios From Two CalEERAM Versions, Compared to Other POU’s .....	172
Figure 90: Target Energy Savings as a Percentage of Base Energy Use—Pasadena.....	173
Figure 91: Pasadena’s Targets, Compared With the 12 Largest POU’s.....	174
Figure 92: Technical and Economical Energy Savings Potential (MWh)—Riverside .....	177
Figure 93: Technical and Economic Demand Savings Potential (MW)—Riverside .....	178
Figure 94: Target Energy Savings as a Percentage of Economic Savings Potential—Riverside .	179
Figure 95: Riverside’s Historical Annual Energy Efficiency Program Savings and Targets.....	180
Figure 96: Riverside’s Market Savings Potential (MWh) by End Use .....	182
Figure 97: Riverside’s Market Savings Potential (kW) by End Use .....	183
Figure 98: Riverside’s TRC Ratios From Two Versions of CalEERAM, Compared to Other POU’s .....	185
Figure 99: Target Energy Savings as a Percentage of Base Energy Use—Riverside.....	186
Figure 100: Riverside’s 10-Year Cumulative Targets, Compared With 12 of the Largest POU’s	187
Figure 101: Technical and Economical Energy Savings Potential (MWh)—Roseville .....	191
Figure 102: Technical and Economic Demand Savings Potential (MW)—Roseville .....	192
Figure 103: Target Energy Savings as a Percentage of Economic Savings Potential—Roseville	193
Figure 104: Roseville’s Historical Annual Energy Efficiency Program Savings and Targets .....	194
Figure 105: Roseville’s Market Savings Potential (MWh) by End Use.....	195
Figure 106: Roseville’s Market Savings Potential (kW) by End Use.....	196
Figure 107: Roseville’s TRC Ratios From the Two CalEERAM Versions, Compared to Other POU’s .....	198

Figure 108: Target Energy Savings as a Percentage of Base Energy Use—Roseville .....	199
Figure 109: Roseville’s Targets Compared With All POU’s.....	200
Figure 110: Technical and Economical Energy Savings Potential (MWh)—Silicon Valley .....	204
Figure 111: Technical and Economic Demand Savings Potential (MW)—Silicon Valley .....	205
Figure 112: Target Energy Savings as a Percentage of Economic Savings Potential—Silicon Valley .....	206
Figure 113: Silicon Valley’s Historical Annual Energy Efficiency Program Savings and Targets .....	207
Figure 114: Silicon Valley’s Market Savings Potential (MWh) by End Use.....	208
Figure 115: Silicon Valley’s Market Savings Potential (kW) by End Use.....	209
Figure 116: Silicon Valley’s TRC Ratios From the Two CalEERAM Versions, Compared to Other POU’s .....	211
Figure 117: Target Energy Savings as a Percentage of Base Energy Use—Silicon Valley .....	212
Figure 118: Silicon Valley’s Targets, Compared With the 12 POU’s .....	213
Figure 119: Technical and Economical Energy Savings Potential (MWh)—Truckee .....	219
Figure 120: Technical and Economic Demand Savings Potential (MW)—Truckee.....	220
Figure 121: Target Energy Savings as a Percentage of Economic Savings Potential—Truckee..	221
Figure 122: Truckee’s Historical Annual Energy Efficiency Program Savings and Targets .....	222
Figure 123: Truckee’s Market Savings Potential (MWh) by End Use.....	223
Figure 124: Truckee’s Market Savings Potential (kW) by End Use.....	224
Figure 125: Truckee’s TRC Ratio From Its CalEERAM Model, Compared to Other POU’s .....	226
Figure 126: Target Energy Savings as a Percentage of Base Energy Use—Truckee .....	227
Figure 127: Truckee’s Targets in Context of 12 of the Largest POU’s.....	228
Figure 128: Technical and Economical Energy Savings Potential (MWh)—Turlock .....	232
Figure 129: Technical and Economic Demand Savings Potential (MW)—Turlock .....	233
Figure 130: Target Energy Savings as a Percentage of Economic Savings Potential—Turlock ..	234
Figure 131: Turlock’s Historical Annual Energy Efficiency Program Savings and Targets.....	235
Figure 132: Turlock’s Market Savings Potential (MWh) by End Use .....	236
Figure 133: Turlock’s Market Savings Potential (kW) by End Use .....	237
Figure 134: Turlock’s TRC Ratios From Two CalEERAM Versions, Compared to Other POU’s	238
Figure 135: Target Energy Savings as a Percentage of Base Energy Use—Turlock.....	239
Figure 136: Turlock’s Targets, Compared With the Largest POU’s.....	240

Figure B-1: Conceptual Relationship Among Energy Efficiency Potential Definitions	4
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## LIST OF TABLES

Table 1: Estimated Potentials for Publicly Owned Utilities (Excluding SMUD and LADWP).....	4
Table 2: Savings Potential by Sector (2011-2020) .....	6
Table 3: Summary of Reported Savings and Annual Targets by Utility Group and Size – MWh .	7
Table 4: Timeline for Model Updates and Target Adoption.....	21
Table 5: Effect of Data Errors on Market Potential in CalEERAM Model Runs .....	23

Table 6: Estimated Potentials for CMUA Group .....	32
Table 7: Market Potential by Sector .....	40
Table 8: Energy Reduction Targets as a Percentage of Energy Use, 2011 to 2018.....	47
Table 9: Demand Reduction Targets as a Percentage of Base Demand, 2011 to 2018 .....	48
Table 10: Summary of Reported Savings and Annual Targets by Utility Group and Size—MWh .....	50
Table 11: Included Customer Segments by Utility, as Organized in CalEERAM.....	56
Table 12: Standard Measure List for the CalEERAM Model .....	58
Table 13: Measures Explicitly Excluded From Economic and Market Potential, by Utility .....	60
Table 14: Measures Explicitly Included in Economic and Market Potential, by Utility .....	61
Table 15: Comparison of Published Market Potential With Market Potential Calculated Using 75 Percent Incentives .....	79
Table 16: Consistency Between POU Model Inputs .....	85
Table 17: Target Assessment—Anaheim .....	104
Table 18: Target Assessment—Burbank .....	116
Table 19: Target Assessment—Glendale.....	128
Table 20: Target Assessment—Imperial .....	140
Table 21: Target Assessment—Modesto .....	151
Table 22: Target Assessment—Palo Alto .....	162
Table 23: Target Assessment—Pasadena.....	175
Table 24: Target Assessment—Riverside.....	188
Table 25: Measures Explicitly Excluded or Included in Analysis—Roseville .....	189
Table 26: Scenario Incentives, Percentage of Incremental Cost—Roseville .....	190
Table 27: Target Assessment—Roseville .....	201
Table 28: Target Assessment—Silicon Valley .....	215
Table 29: Measures Explicitly Excluded or Included in Analysis—Truckee.....	217
Table 30: Residential Scenario Incentives, Percentage of Incremental Cost—Truckee .....	218
Table 31: Target Assessment—Truckee .....	229
Table 32: Residential Scenario Incentives, Percentage of Incremental Cost—Turlock .....	230
Table 33: Comparison of Turlock’s Administrative Costs to Typical Administrative Costs .....	231
Table 34: Target Assessment—Turlock.....	241
Table B-1. Program Potential Model Outputs for Year 5 of Program.....	43
Table A-1: Achievable Potential Estimates as a Percentage of Base Load – Recent Studies in the United States and Canada.....	1
Table B-2: Comparison of 2007 and 2010 Energy Potentials and Targets—All Sectors .....	47
Table B-3: Comparison of 2007 and 2010 Energy Potentials and Targets—Residential Sector.....	48
Table B-4: Comparison of 2007 and 2010 Efficiency Potentials and Targets—Nonresidential Sector.....	49
Table B-5: Comparison of 2007 and 2010 Demand Potentials and Targets—All Sectors.....	50
Table B-6: Comparison of 2007 and 2010 Demand Potentials and Targets—Residential Sector ..	51

Table B-7: Comparison of 2007 and 2010 Demand Potentials and Targets—Nonresidential Sector .....	52
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Table C-1: Comparison of Key Model Inputs by Utility	1
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## EXECUTIVE SUMMARY

In response to the legislative mandates of Senate Bill 1037 (Kehoe, Chapter 366, Statutes of 2005) and Assembly Bill 2021 (Levine, Chapter 734, Statutes of 2006), this report provides an assessment of the energy efficiency potential for publicly owned utilities (POU) and the efficiency savings targets now adopted for 2011–2020.

Senate Bill 1037 and Assembly Bill 2021 mandated electric and gas utilities in California to install cost-effective and feasible energy efficiency measures. Senate Bill 1037 requires all publicly owned utilities to report to the California Energy Commission and their local governing boards on current and projected energy efficiency programs, including expenditures and savings. Assembly Bill 2021 sets utilities on the path to procure all cost-effective energy efficiency so that the state can meet the goal of reducing total forecasted electricity consumption by 10 percent over the next 10 years. Assembly Bill 2021 requires publicly owned utilities to:

- Report annually on efficiency expenditures, savings, and the cost-effectiveness of their efficiency programs to the Energy Commission.
- Submit third-party evaluation, measurement, and verification (EM&V) studies to verify program savings to the Energy Commission.
- Work with the Energy Commission to identify all potentially achievable, cost-effective energy savings and establish targets for a 10-year period.
  - Identify achievable cost-effective electricity energy efficiency potential every three years.
  - Establish annual targets based on that potential for a 10-year period.

The Energy Commission will provide, in consultation with the California Public Utilities Commission as the regulator of investor-owned utility (IOU) energy efficiency programs, a statewide estimate of energy efficiency potential and targets for a 10-year period. The Energy Commission is fulfilling the Assembly Bill 2021 requirements by evaluating both the efficiency targets adopted by publicly owned utilities, and the method used to estimate energy efficiency potential and develop the targets. The California Municipal Utilities Association (CMUA) March 2010 report *Energy Efficiency in California's Public Power Sector* and the completed energy efficiency potential models submitted by publicly owned utilities documented the 10-year energy efficiency potentials and adopted targets. The California Municipal Utilities Association used the California Energy Efficiency Resource Assessment Model<sup>1</sup> to estimate energy efficiency potential. The model estimated the technical, economic, and market savings potential for residential, commercial, and industrial sectors for the publicly owned utilities in 2010.

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<sup>1</sup> The Energy Efficiency Resource Assessment Model is an Excel® spreadsheet model based on the integration of energy efficiency measure impacts and costs, utility customer characteristics, utility load forecasts, and utility avoided costs and rate schedules.

This report includes an estimate of the efficiency potential for publicly owned utility efficiency savings targets adopted for the next 10 years, with two major exceptions. The two largest publicly owned utilities, Sacramento Municipal Utility District (SMUD) and Los Angeles Department of Water and Power (LADWP), did not participate in the California Municipal Utility Association's 2010 potential and target study. In fact, neither Sacramento Municipal Utility District nor Los Angeles Department of Water and Power submitted updated energy efficiency potential studies.

Sacramento Municipal Utility District did submit updated energy efficiency targets for 2011 through 2020. Los Angeles Department of Water and Power did not. Therefore, this report uses Los Angeles Department of Water and Power targets set in 2007 for 2011 through 2016. No analysis of energy efficiency potentials is made for these two utilities because the updated data does not exist.

## Approach

### *Assessing Targets and Energy Efficiency Potentials Across All Utilities*

The California Municipal Utilities Association's March 2010 report included California Energy Efficiency Resource Assessment Model outputs for 36 utilities. These results included megawatt hour (MWh) targets, targets as a percentage of load forecast, and technical, economic, and market energy and demand savings potential by sector. In addition, 12 of the larger utilities submitted, as requested, copies of completed California Energy Efficiency Resource Assessment Models. These model results provided additional forecast detail, which analysts combined with the corresponding reported results for the 24 smaller utilities.

The assessment across all utilities addressed the following questions:

- **Adopted Targets** – What are the range and size of the adopted targets? How much of the load forecast do those targets capture? How do the targets relate to the market and economic savings potentials for each utility? How quickly do the targets ramp up? How do the new targets compare with the previous targets adopted in 2007?
- **Market Savings Potential** – What is the trend in market savings potentials, as estimated by the utilities? Are market savings potentials comparable between utilities? How do estimated program costs per kilowatt hour (kWh) compare?
- **Technical and Economic Savings Potential** – How do the complete penetration of efficiency measures where they are technically feasible (technical savings potential) and what is achievable if a utility installs measures in all feasible, cost-effective applications (economic savings potential) compare across utilities? How do those technical and economic savings potentials change over time compared with utility load forecasts? How do the potentials compare with the previous 2007 potential estimates?

## *Assessing Targets and Energy Efficiency Potentials for 12 of the Larger Utilities*

KEMA developed two frameworks to evaluate the California Energy Efficiency Resource Assessment Model and associated analysis conducted by 12 of the larger publicly owned utilities. The frameworks provided a consistent and systematic approach for assessing the energy efficiency potentials and associated targets adopted by those utilities.

The first framework focused on model structure and capabilities, including the documentation of assumptions, the approach to baseline energy use, and how the California Energy Efficiency Resource Assessment Model calculates technical, economic, and market savings potentials. KEMA also evaluated how consistent the energy efficiency potential estimation method is with those of other POUs and IOUs in California. KEMA used the first framework to assess Anaheim's California Energy Efficiency Resource Assessment Model as representative of the model structure.<sup>2</sup>

The second framework focused on how each of 12 POUs applied the Energy Efficiency Resource Assessment Model. KEMA evaluated the Energy Efficiency Resource Assessment Model inputs that those utilities used. The framework included criteria related to listing data by individual customers (customer disaggregation), the measures included, and associated measure assumptions (including savings, costs, applicability to specific populations, and interactive effects), and consistency with publicly owned utility energy use. KEMA also compared the key outputs across models, including the rate at which a utility fully implements a program (program ramp-up) and per-kWh program costs per unit savings.

## **Findings**

### *Assessment of Energy Efficiency Savings Potentials*

**Table 1** presents the 10 year cumulative energy efficiency potentials estimated for POUs in 2010 (excluding SMUD and LADWP, which did not produce updated potentials), compared with the potentials estimated in 2007. Technical savings potential refers to all savings potential that would occur if all energy efficiency measures were installed in all feasible applications. The POUs estimated technical energy savings potential at 10,693 gigawatt hours (GWh) through 2020. This represents 33 percent of base energy use in 2020 and is 96 percent higher than the 2007 estimate of technical savings potential estimated for 2016 for the same utilities. This marked increase is likely the result of a more comprehensive and detailed modeling approach rather than an actual change in potential. The 2007 assessment used a top-down modeling approach, which combined potential estimates from another study for the California investor-owned utilities<sup>3</sup> with information on publicly owned utility energy use and number of

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<sup>2</sup> KEMA found few differences in the model structure, as applied across the publicly owned utilities.

<sup>3</sup> Itron, 2006. *California Energy Efficiency Potential Study*. Prepared for Pacific Gas and Electric, Southern California Edison, and San Diego Gas & Electric.

customers. The 2010 model is a bottom-up model that builds up savings from assumptions about measure costs and savings, building stocks, equipment saturation, adoption patterns, codes and standards, and energy prices.

**Table 1: Estimated Potentials for Publicly Owned Utilities (Excluding SMUD and LADWP)**

	<u>Energy Savings Potentials – GWh</u>			<u>Demand Savings Potentials – MW</u>		
	Technical	Economic	Market	Technical	Economic	Market
Current Analysis (2010), 2011-2020	10,693	9,525	2,143	2,861	2,283	526
Previous Analysis (2007), 2007-2016	5,460	4,038	2,109	732	507	302

Source: Data from 2010 obtained from California Municipal Utilities Association, *Energy Efficiency in California's Public Power Sector. A Status Report*, March 2010 for 24 utilities, combined with California Energy Efficiency Resource Assessment Models (October 2010) for 11 utilities. Data from 2007 obtained from California Municipal Utilities Association, *Establishing Energy Efficiency Targets: A Public Power Response to AB2021. Final Update*, October 2007.

This estimate of technical energy savings potential relative to base energy use is high compared with the technical savings potential for the California investor-owned utilities, which was 22 percent of base energy use in the 2008 study<sup>4</sup>.

Technical savings potential for demand reduction is 2,861 MW in 2020, which is almost four times higher than the 2007 estimate for 2016.

Economic savings potential is the savings potential that would occur if a utility installed measures in all feasible, cost-effective applications. In the 2010 study the economic energy savings potential estimate for the publicly owned utilities is 9,525 GWh through 2020, or 29 percent of base energy use. This estimate of economic savings potential is 136 percent higher than the 2007 estimate of economic savings potential in 2016 for the same utilities. It is also higher than the economic savings potential estimated for the investor-owned utilities, which was 19 percent of base energy use. The economic demand savings potential estimate is 2,283 MW in 2020, which is more than four times higher than the 2007 estimate for 2016.

The most significant efficiency potential for target setting and program planning is market savings potential, which includes the effects of program design, customer preferences, and market conditions. With few exceptions, publicly owned utilities used the estimated market savings potential for their revised targets for 2011-2020.

For publicly owned utilities (excluding Sacramento Municipal Utility District and Los Angeles Department of Water and Power), the market energy savings potential estimate through 2020 was 2,205 GWh, which is slightly higher than the 10-year market savings potential estimated for the same utilities in 2007. This estimate represents about 6.8 percent of electricity use. By comparison, the estimated 10-year energy savings market potential for the investor-owned

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<sup>4</sup> Itron, 2008. *California Energy Efficiency Potential Study*. Prepared for PG&E on behalf of California investor-owned utilities.

utilities ranged from 3 percent to 6 percent of electricity use. The market demand savings potential estimate is 526 MW in 2020, which is 74 percent higher than the 2007 estimate for 2016.

The market savings potential for publicly owned utilities is about 23 percent of the estimated economic savings potential over the 10-year period. By comparison, the 10-year cumulative market savings potential for the investor-owned utilities ranged from 15 percent to 33 percent of economic savings potential.<sup>5</sup>

The current publicly owned utility market savings potential, which covers about 0.7 percent of energy use per year, appears to reflect a moderate level of program effort compared to studies conducted across the United States in recent years.<sup>6</sup> Most of the utilities' estimated market savings potentials do not meet the "10 percent of base electricity use" requirement over 10 years set out in Assembly Bill 2021. Pasadena and Truckee were the only utilities of the 12 studied in detail with market savings potential that reached that target. This review, however, identified modeling issues suggest the market savings potentials for those two utilities may be overstated for the given level of program effort. For example, Pasadena may have overstated office floor space, while Truckee may not in fact have the savings potential suggested by the model for the ground-source heat pumps.

In most cases, market savings potential calculations used 50 percent incentives. When KEMA used the publicly owned utilities' models to run alternative 75 percent incentive scenarios, all but one of the 12 utilities in the detailed study met their 10 percent goal. This analysis indicates that those utilities could meet their Assembly Bill 2021 goals but may require higher levels of program effort and budget than currently factored into their targets.

**Table 2** shows publicly owned utility savings potentials, by sector, for 2020. The non-residential potential accounts for 74 percent of technical savings potential, 78 percent of economic savings potential, and 79 percent of market savings potential. This result shows that those utilities need to focus significant program attention on their nonresidential customers to save the required energy needed to meet their energy use reduction goals.

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5 For the 2008 IOU study, analysts developed three primary market savings potential scenarios: a base scenario that mirrored 2004-2005 programs, a full incentive scenario that assumes incentives cover 100 percent of incremental measure costs, and a mid scenario with incentives halfway between the base and full scenarios.

6 A comparison of recent potential studies and their scenarios shows that about half of the market savings potentials reflect annual savings between 0.4 percent and 1.0 percent of consumption, with the remainder showing annual savings greater than 1.0 percent of consumption. See Appendix A.

**Table 2: Savings Potential by Sector (2011-2020)**

Sector	Energy Savings Potentials – GWh			Demand Savings Potentials – MW		
	Technical	Economic	Market	Technical	Economic	Market
Non-Residential	7,882	7,407	1,689	1,818	1,693	384
Residential	2,811	2,119	454	1,044	590	142

Source: Data obtained from California Municipal Utilities Association, *Energy Efficiency in California's Public Power Sector. A Status Report*, March 2010 for 25 utilities, combined with California Energy Efficiency Resource Assessment Models (October 2010) for 11 utilities.

### *Assessment of Targets*

Twenty-four of the 36 publicly owned utilities set targets equal to the market savings potentials published in the California Municipal Utilities Association's March 2010 report. The remaining 12 utilities (Alameda, Glendale, Gridley, Healdsburg, Lassen, Palo Alto, Pasadena, Port of Oakland, Shasta Lake, Trinity, Truckee, and Ukiah) set targets that differed from their respective March 2010 market savings potentials.

Sacramento Municipal Utility District submitted revised savings targets to the Energy Commission in 2010. Los Angeles Department of Water and Power is updating its targets, so at this writing, its 2007 targets remain in effect for this analysis. **Table ES3** summarizes the targets of these two large utilities and utilities in the CMUA group as a whole. The latter targets also separate into subgroups by utility size. Because both Sacramento Municipal Utility District and Los Angeles Department of Water and Power are much larger than other publicly owned utilities in the California Municipal Utilities Association group, they have correspondingly higher targets. Sacramento Municipal Utility District's target is comparable to the total targets for the largest 12 publicly owned utilities in the California Municipal Utilities Association group. All these utilities together have a target of 607 GWh in 2011, with a cumulative target of 7,171 GWh from 2011 to 2020 (assuming Los Angeles Department of Water and Power's targets remain flat from 2016 through 2020).

In addition to those targets, **Table 3** shows reported 2009 savings for comparison. Half of the utilities in the California Municipal Utilities Association group set their 2011 targets for less than their 2009 reported savings. Collectively, 2011 targets for the California Municipal Utilities Association group added up to only 89 percent of 2009 reported savings.

**Table 3: Summary of Reported Savings and Annual Targets by Utility Group and Size – MWh**

	<b>2009 Reported</b>	<b>2011</b>	<b>2012</b>	<b>2013</b>	<b>2014</b>	<b>2015</b>	<b>2016</b>	<b>2017</b>	<b>2018</b>	<b>2019</b>	<b>2020</b>
<b>LADWP*</b>	287,574	255,000	252,000	252,000	252,000	252,000	252,000	NA	NA	NA	NA
<b>SMUD</b>	148,028	166,000	169,000	171,000	175,000	179,000	183,000	185,000	187,000	190,000	194,000
<b>CMUA Group**</b>	208,209	186,048	178,090	191,537	218,269	239,807	249,461	245,306	238,218	231,724	226,448
<b>CMUA Group Largest 12</b>	186,633	166,723	160,825	172,079	195,065	213,822	221,456	216,308	208,730	202,142	196,740
<b>CMUA Group Middle 12</b>	19,967	17,308	15,348	17,394	20,868	23,430	25,192	26,050	26,453	26,460	26,491
<b>CMUA Group Smallest 12</b>	1,609	2,017	1,917	2,064	2,336	2,555	2,813	2,948	3,035	3,122	3,217
<b>Total – All POU's</b>	643,811	607,048	599,090	614,537	645,269	670,807	684,461	682,306 *	677,218 *	673,724 *	672,448 *

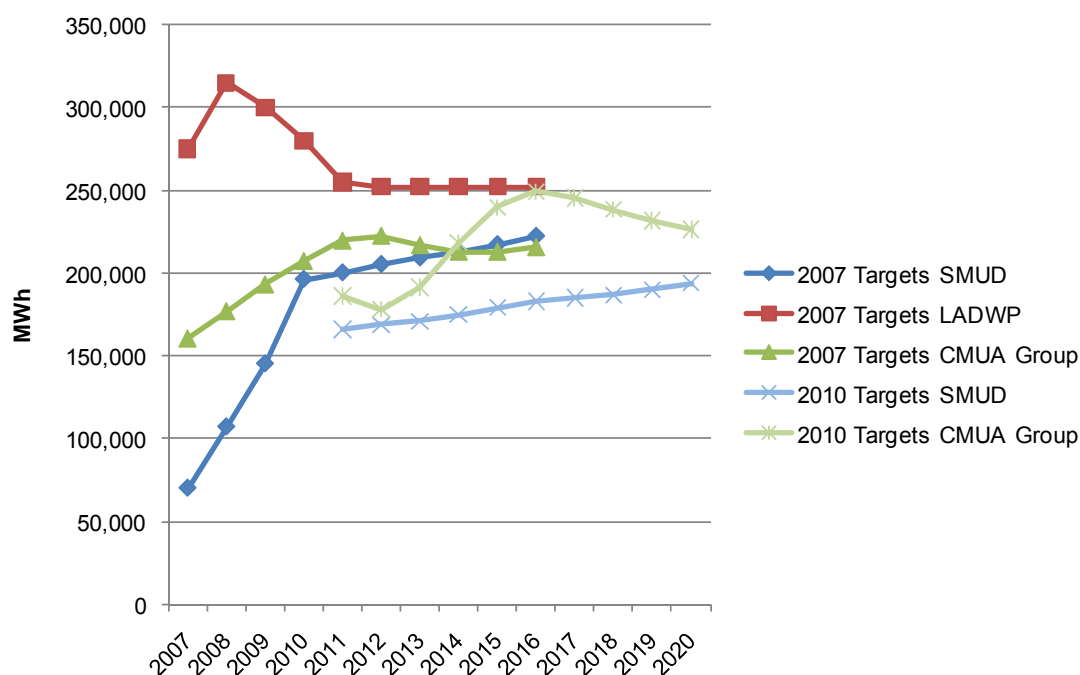
\*Because Los Angeles Department of Water and Power's targets set in 2007 extend only through 2016, the total annual targets from 2017 to 2020 assume a LADWP target of 252,000 MWh for these years.

\*\* Refers to the 36 publicly owned utilities who reported energy efficiency savings, energy savings potentials, and targets in the California Municipal Utilities Association March 2010 report.

Source: Data for LADWP obtained from California Municipal Utilities Association, *Establishing Energy Efficiency Targets: A Public Power Response to AB2021. Final Update*. October 2007. Data for SMUD obtained from informal PowerPoint presentation titled "SMUD's AB 2021 2011-2020 Goals.pptx" dated May 4, 2010. Data for CMUA Group obtained from California Municipal Utilities Association, *Energy Efficiency in California's Public Power Sector. A Status Report*, March 2010. Data for 2009 reported savings obtained from California Municipal Utilities Association, *Energy Efficiency in California's Public Power Sector. A Status Report*, March 2009.

**Figure 1** compares the 2007 targets to the 2010 targets over time by utility group. Both the Sacramento Municipal Utility District and the California Municipal Utilities Association groups lowered their targets for 2011 through 2013. This may be due, in part, to both the effect of codes and standards revisions (especially for lighting), and the recession that adversely affected business and personal spending, including investment in energy efficiency. Sacramento Municipal Utility District's revised targets show a ramp-up from 2011 to 2016 that is similar to its 2007 targets. The California Municipal Utilities Association group's 2007 targets flattened after 2011; its revised targets show a marked ramp-up from 2012 to 2016 that is even steeper than the ramp-up in the 2007 targets from 2007 to 2011.

**Figure 1: Comparison of 2007 Targets to 2010 Targets**

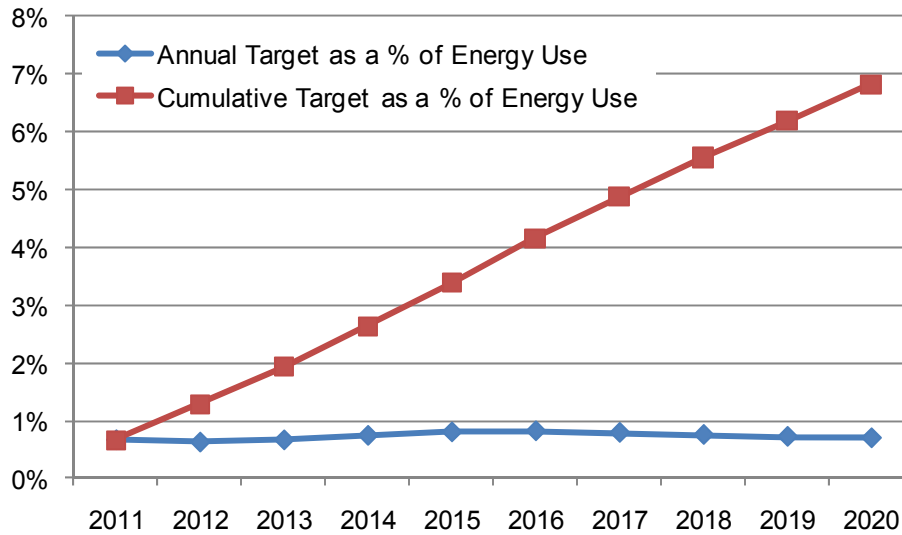


Note: Los Angeles Department of Water and Power has not set revised targets, so its 2007 targets remain in effect.

Source: Data from 2007 obtained from California Municipal Utilities Association, *Establishing Energy Efficiency Targets: A Public Power Response to AB2021. Final Update*. October 2007. Data for 2010 SMUD obtained from informal PowerPoint presentation titled "SMUD's AB 2021 2011-2020 Goals.pptx" dated May 4, 2010. Data for 2010 CMUA Group obtained from California Municipal Utilities Association, *Energy Efficiency in California's Public Power Sector. A Status Report*, March 2010.

The energy reduction goal laid out in Assembly Bill 2021 corresponds to 1 percent of base energy use per year. **Figure 2** shows the aggregate targets for the 36 utilities in the California Municipal Utilities Association group over time, both annual and cumulative. Annual targets vary somewhat from year to year but never reach 1 percent. The publicly owned utility targets combined do not meet the goal of Assembly Bill 2021, reaching only savings of 6.8 percent of forecasted 2020 base energy use. By comparison, SMUD's revised 10-year target is almost 14 percent of forecasted base energy use. LADWP's 10-year target from 2007 to 2016 was 10.4 percent. The utility has not submitted revised targets.

**Figure 2: CMUA POU Annual and Cumulative Targets as a Percent of Energy Use**

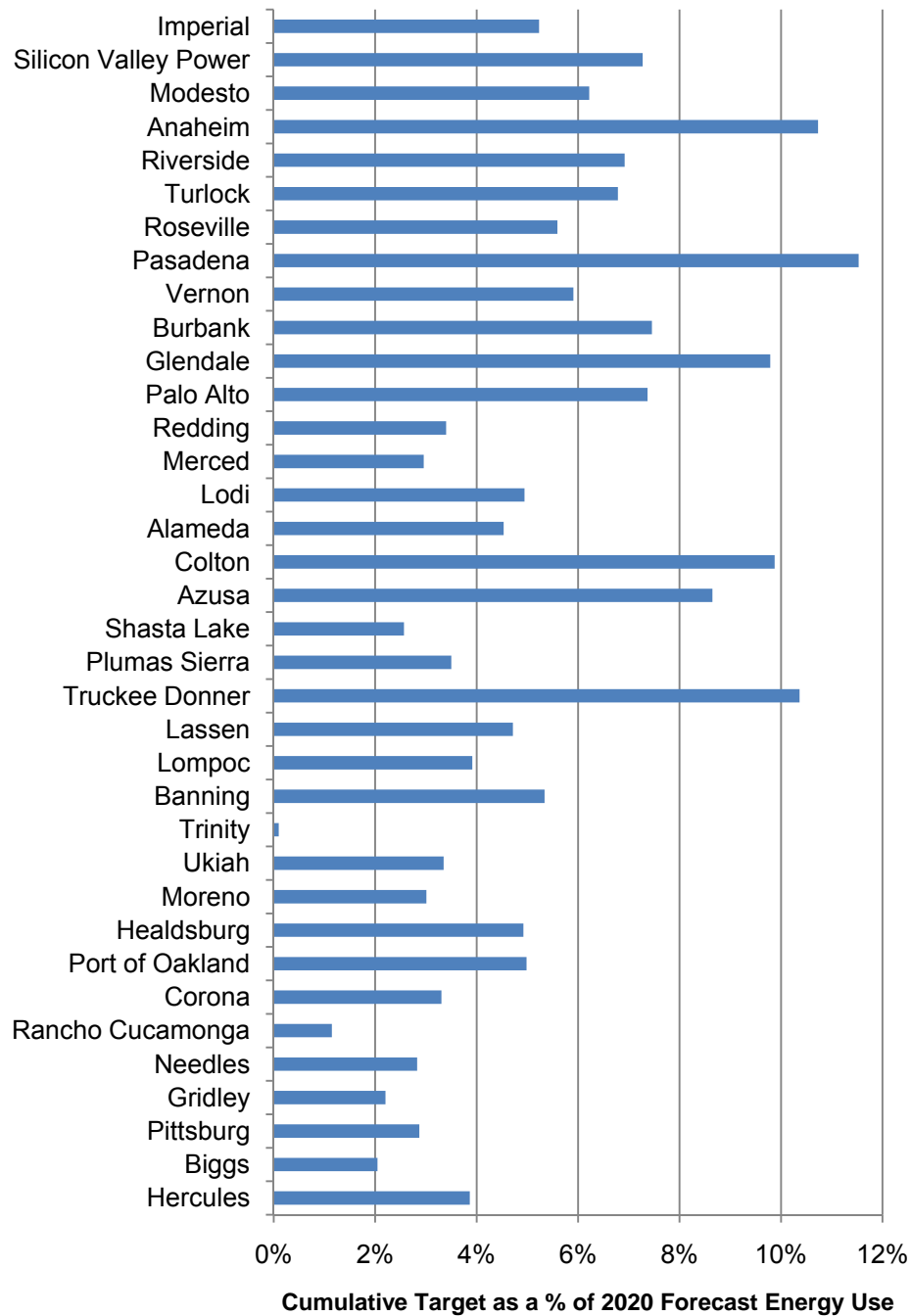


Source: California Municipal Utilities Association, *Energy Efficiency in California's Public Power Sector. A Status Report*, March 2010.

**Figure 3** shows 10-year cumulative targets, by utility, as a percentage of forecasted base energy use. The utilities are ranked, smallest to largest, by system load. While there is a great deal of individual variation, targets tend to be higher for larger utilities and smaller for smaller utilities. The average 10-year target for the 12 largest utilities was 7.6 percent of base energy use, while the average for the 12 smallest was only 2.9 percent. The mid-sized utilities had a mix of high and low targets, averaging 5.4 percent of base energy.

Only 3 of the 36 publicly owned utilities (Pasadena, Anaheim, and Truckee) have targets that meet their 10-year Assembly Bill 2021 goals, with two others (Glendale and Colton) falling only slightly short, possibly due to rounding errors. KEMA calculated base energy use from data in the California Municipal Utilities Association's March 2010 report but did not have the actual base usage, which could lead to rounding errors.

**Figure 3: 10-year Cumulative Targets as Percentage of 2020 Energy Use, Ranked by Utility Energy Use**



Source: California Municipal Utilities Association, *Energy Efficiency in California's Public Power Sector. A Status Report*, March 2010.

### *Assessment of California Energy Efficiency Resource Assessment Model*

Technical and economic savings potential changed sharply between the 2007 and 2010 potential studies, due to very different modeling approaches as explained previously. KEMA found the approach and algorithms of the Energy Efficiency Resource Assessment Model to be sound. Model inputs came from reliable sources, and KEMA identified only a few issues. The key issues include:

- A publicly owned utility can calibrate market savings potentials based on its past program experience (level of savings relative to program costs, for example). The purpose of this calibration is to account for local market receptivity to program efforts. At least one publicly owned utility, however, used the calibration to produce market savings potentials to meet the requirements of Assembly Bill 2021 (10 percent savings over 10 years), rather than calibrating to past program experience. In this case, the “market savings potential” is not a market savings potential at all and is not comparable to the market savings potential of utilities that calibrated to past program experience. Ideally one would calibrate the model to past experience and then use the model to adjust program effort to meet a desired target.
- Publicly owned utilities can explicitly exclude energy efficiency measures from their economic savings potential analysis, even when they are cost-effective, which produces lower estimates of economic savings potential. This is not an appropriate approach for modeling economic savings potential. While there may be good reasons for excluding certain cost-effective measures from utility programs, such omissions should apply to market – not economic – potential.
- The treatment of home air conditioning resulted in no cost-effective savings for most publicly owned utilities. The lowest efficiency air-conditioning measure for existing homes in most of the models was a ratio of cooling output divided by electrical input, or seasonal energy efficiency ratio (SEER) 16+. Inclusion of SEER 14 or SEER 15 air-conditioning measures, which are generally more cost-effective than the higher SEER units, would likely increase the estimates of air conditioning savings potential.
- Quality control appeared to be an issue in several errors KEMA identified. These included a data error resulting in incorrect measure savings for certain commercial building types, incorrect electric rates for Pasadena, incorrect climate zones for some measures in some models, and incorrect floor space for Pasadena offices.
- The model allowed a limited number of nonresidential building types in the analysis. The focus on the top three commercial building types by electricity use in each publicly owned utility service territory (which differed by utility) made it difficult to compare results across all the publicly owned utilities.
- The absence of a documented baseline analysis (energy balance or market characterization) makes it difficult to identify errors like Pasadena’s office floor space issue.
- The use of an 80 percent net-to-gross ratio is optimistic in light of recent California program evaluations for the IOUs.

## Recommendations

The following summarizes recommendations related to the key findings listed above.

### *Enhance California Energy Efficiency Resource Assessment Model and Method for Next Round of Target Setting*

KEMA recommends that publicly owned utilities use the existing California Energy Efficiency Resource Assessment Model for the next round of target setting. The model is basically sound, and analysts can address the issues identified in this report during the next modeling cycle. It is usually less expensive to update an existing model than to begin from scratch, and it is best to avoid radical changes in method. Furthermore, the publicly owned utilities and Energy Commission have already invested significant resources to understand and use the current model.

KEMA recommends the following revisions to the California Energy Efficiency Resource Assessment Model:

- Utilities should calculate market savings potential without regard for any targets the individual POU has in mind. Utilities can set targets that are different from market savings potential, as some did in 2010.
- The potential models should screen economic savings potential only for cost effectiveness, without additional screening for market savings potential. Any such screen should occur at the market potential stage of the analysis.
- The model should include a consistent core set of commercial building types, for example, office, retail, health, school, restaurant, grocery, lodging, and miscellaneous.
- For measures with multiple high-efficiency options (such as SEER 14, SEER 15, or SEER 16 for central air conditioners), the model should assess whether *any* of the efficiency levels pass the total resource cost test, not just the highest-efficiency level.
- The potential analysis should include a documented analysis of baseline energy use.
- The net-to-gross values used in the model should consider California investor-owned utility evaluation results.

### *Improve Documentation of Potential Estimates and Targets*

To comply properly with the requirements of Assembly Bill 2021, the Energy Commission needs documentation to understand the assumptions behind the potential estimates and energy efficiency targets adopted by the utilities. The following documentation should be required:

- Utilities should provide the Energy Commission with the version of the model that they used to calculate the targets.

- Publicly owned utilities and the consultants conducting the potential study should document the ways in which they customized the model and the reasons for the customization.

#### *More Proactive Program Planning to Meet the Goals of Assembly Bill 2021*

The analysis of POU energy efficiency potentials and targets revealed that only 3 of the 36 publicly owned utilities are on track to achieve the 10-year Assembly Bill 2021 goals. In fact, the aggregated publicly owned utility targets are at 6.8 percent of forecasted 2020 base energy use, compared to the 10 percent statewide goal. Thus, publicly owned utilities should take more proactive steps to achieve the statewide energy efficiency goals, including:

- Implement a more aggressive ramp-up of energy efficiency targets and programmatic initiatives, particularly the smaller publicly owned utilities.
- Develop a detailed plan to achieve the 10 percent savings goal.
- Consider higher incentive levels and an expanded portfolio of energy efficiency programs.
- Capture economies of scale by partnering with other POUs or IOUs.



# CHAPTER 1: Introduction

## Background

Two legislative bills, Senate Bill (SB) 1037 (Kehoe, Chapter 366, Statutes of 2005) and Assembly Bill (AB) 2021 (Levine, Chapter 734, Statutes of 2006), promote energy efficiency in California's investor-owned utilities (IOUs) and publicly owned utilities (POUs) so that the efficiency resource will contribute more toward meeting critical state goals of electric reliability and environmental mitigation.

SB 1037 (SB 1037) codified the pursuit of energy efficiency as the first priority in the loading order of supply resources to meet the utilities' energy demands. The bill requires the California Public Utilities Commission (CPUC), in consultation with the California Energy Commission, to identify all potentially achievable cost-effective electric and natural gas energy efficiency measures for the IOUs, set goals for achieving this potential, review the energy procurement plans of IOUs, and consider cost-effective supply alternatives such as energy efficiency. In addition to these IOU requirements, SB 1037 requires that all POUs report investments in energy efficiency programs annually to their customers and to the Energy Commission.

In 2006, AB 2021 added specific mandates that increased California's energy efficiency programs, especially for POUs. AB 2021 directs POUs to "first acquire all available energy efficiency and demand reduction resources that are cost-effective, reliable, and feasible." POUs, like IOUs, are to treat efficiency as a procurement investment. The legislation also requires POUs to:

- Report annually on efficiency expenditures, savings, and the cost-effectiveness of their efficiency programs, and report this information to the Energy Commission for evaluation.
- Perform third-party evaluation, measurement, and verification (EM&V) studies to verify program savings, and submit to the Energy Commission.
- Work with the Energy Commission to identify all potentially achievable cost-effective energy savings, and establish targets for a 10-year period. The Energy Commission will provide, in consultation with the CPUC as the regulator of IOU energy efficiency programs, a statewide estimate of energy efficiency potential and targets for a 10-year period.
  - Publicly owned utilities shall identify achievable cost-effective energy efficiency potential every three years.
  - Publicly owned utilities shall establish annual targets based on that potential for a 10-year period.

The energy agencies and the utilities first met the requirement of AB 2021 in December 2007 when Energy Commission developed statewide targets and utility-specific targets.<sup>7</sup> In 2004, the CPUC adopted the IOUs' initial goals used in the analysis.<sup>8</sup> The California Municipal Utilities Association (CMUA) developed many of the POU efficiency potential estimates and targets.<sup>9</sup>

The Energy Commission's December 2007 study proposed criteria and options for acceptable IOU and POU targets, which varied the levels of savings as a percentage of economic potential and as a percentage of forecasted consumption. For the 2007 report, the ultimate interpretation of the legislation's objective of "achieving all potentially achievable, cost-effective, energy efficiency" was realizing 100 percent of economic potential. This was an unusually high bar; the IOUs' 2007 energy goals were more than 21,000 GWh for the period 2007-2016, representing 74 percent of their economic potential. The POUs' energy goals were 6,600 GWh, which represented 62 percent of their economic potential. Staff expected the IOUs' savings to achieve 10 percent of their forecasted consumption in 2020, and the POUs' savings to achieve 9.3 percent of theirs.

Following AB 2021 dictates, staff analyzed the larger POUs' proposed targets for 2007-2016 for feasibility and reliability. Staff's evaluation of these criteria to determine the feasibility of the POUs' target proposals included the magnitude of the proposed savings relative to historical savings, and the ramp up rate for the programs to produce the savings. Despite the assessment in 2007 that many POUs estimated these too generously, the Energy Commission's evaluation of POU annual reported savings from 2007-2010 shows that many utilities were able to implement programs and generate savings at an impressive pace.

This report uses the initial evaluation of POU efficiency potential and targets from the Energy Commission's 2007 study as one point of departure. The report compares some of relevant results of the initial 2007 study with the updated savings potentials and adopted targets.

## **Study Scope and Key Objective**

As directed by AB 2021, the POUs revised their efficiency potential study and targets in 2010. The planned progress report in 2010 would have contained the anticipated revision of both IOU and POU efficiency potential, goals, and targets. The Energy Commission, hoping to have access to new IOU goals, held the revision until 2011 for a complete revised statewide efficiency

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7 California Energy Commission, *Achieving All Cost-Effective Energy Efficiency for California*, Final Staff Report, CEC-200-2007-019-SF, December 2007.

8 CPUC, Decision 04-09-060, *Interim Opinion on Energy Savings Goals for Program Year 2006 and Beyond*, September 23, 2004.

9 CMUA, *Establishing Energy Efficiency Targets: A Public Power Response to AB 2021*, June 2007 (revised in October 2007). POUs that provided a separate potential study were City of Palo Alto, Los Angeles Department of Water and Power, Redding Power, and Sacramento Municipal Utility District,

potential. The CPUC, however, did not propose new goals for the IOUs' efficiency programs. While the CPUC now has a schedule to revise the IOUs' efficiency goals, it will not approve them until 2013.<sup>10</sup>

This report includes an estimate of the efficiency potential for POU's efficiency savings targets adopted for 2011–2020, with two major exceptions. By September 2010, the Energy Commission received the necessary data for assessment of most POU's revised potential and targets.<sup>11</sup> The two largest publicly owned utilities, Sacramento Municipal Utility District (SMUD) and Los Angeles Department of Water and Power (LADWP), did not participate in CMUA's 2010 potential and target study.

SMUD submitted revised efficiency targets approved by its Board in May 2010; however, it did not revise its efficiency potential estimates. LADWP has been revising its efficiency potential and targets for more than a year; however, revised information will not be available to the Energy Commission until late 2011 at the earliest. Therefore, KEMA includes SMUD's updated targets in this report, along with LADWP's targets that were set in 2007 for 2011 through 2016.

This report fulfills a significant mandate of AB 2021 by evaluating the energy efficiency potential methods submitted by the POU's as well as model outputs such as levels of efficiency potential and targets (MWh, MW).

This study developed methodological criteria and used them in the evaluation of the models and inputs used to develop the energy potential estimates. KEMA developed two frameworks to evaluate the POU efficiency potential model. The first focused on the general structure of the model and investigated model approach and capabilities, documentation adequacy, and consistency with other potential study models. The second focused on the inputs, assumptions, and outputs specific to each utility. It considered efficiency measure types and attributes, measure applicability, customer disaggregation, consistency of total energy use with sales forecast, and consistency of POU efficiency potential results with previous studies.

This report includes an assessment of the POU efficiency savings targets according to the AB 2021 mandate, namely: cost-effectiveness, achievability (or feasibility), reliability, and the capability of fulfilling the energy use reduction goal of a 10 percent reduction of base energy use over 10 years.

KEMA developed specific criteria to evaluate the efficiency targets. KEMA measured cost effectiveness by the total resource cost (TRC) test, a metric that includes the benefits and costs to both the utility and program participants. In addition to the TRC test, KEMA looked at program

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10 CPUC, Commissioner Assigned Ruling Soliciting Comments, November 17, 2010. For this discussion on IOUs' efficiency goal revision, see: <http://docs.cpuc.ca.gov/efile/RULINGS/126625.pdf>.

11 CMUA, *Energy Efficiency in California's Public power Sector: A Status Report*, March 2010. This report provided the initial estimates of revised potential and targets; however, the utilities did not file complete accurate data until September 2010.

expenditures per first-year kWh saved. Unlike TRC, this metric does not take into account participant costs. It does provide an additional metric to compare to utility prices.

In assessing the feasibility of utility targets, KEMA examined the POU's currently offered programs, staffing levels and staff experience, funding processes and budget cycles, and whether the utility boards have adopted the proposed targets. Staff examined targets in the context of both estimated market savings potential, and the utility's record of program savings from 2006 to 2009.

The assessment of reliability took into account two factors. First, has the utility consistently been able to deliver savings that meet its projected savings? That is, has the utility been able to forecast its savings for the following year accurately? The second factor is whether the utility has been assessing its program accomplishments through a rigorous evaluation, measurement, and verification (EM&V) process.

The consumption reduction goal laid out in AB2021 is 10 percent of base energy use over 10 years, which closely corresponds to 1 percent per year. Reviewers compared targets against this goal to see which utilities achieved and which fell short of this target.

## **Organization of the Report**

Chapter 2 describes the analytical approach and models used by the utilities, as well as the input data sources used for the report's analyses.

Chapter 3 presents efficiency savings potential estimates and targets for the 36 POU's who presented this data in the CMUA's March 2010 report. Analysis for the full complement of utilities is limited to comparisons of savings potentials and targets. This chapter contains comparisons of analytical results with the POU's 2007 potential and targets. It also examines the POU and the IOU findings.

Chapter 4 applies the evaluation framework to the efficiency potential models of 12 of the largest utilities. The chapter looks at model structure, inputs and outputs in more detail.

Chapter 5 delves into the details of targets and potential estimates for 12 of the larger utilities. Subsections for each POU provide detailed results, key findings, and target assessments.

Chapter 6 presents conclusions and recommendations from the study.

# CHAPTER 2: Information Sources and Framework Used for Assessing Publicly Owned Utilities' Potentials and Targets

## Objective and Analytical Approach

This chapter describes the data sources and approach for assessing the models and method used to develop revised energy efficiency targets for California's POU's. The chapter focuses on public reports and spreadsheet models submitted by POU's. The chapter also discusses the underlying data sources and how the reports and models are related to one another.

The three utility subsets for analysis are: the CMUA group, LADWP, and SMUD. Of these three, only the CMUA group both completed energy efficiency potential studies and submitted revised targets.

## Methods and Models Used by the Utilities

### CMUA Group

The CMUA March 2010 report *Energy Efficiency in California's Public Power Sector* presented potentials and targets for 36 utilities.

The CMUA group of utilities used Summit Blue's (now Navigant's) California Energy Efficiency Resource Assessment Model (CalEERAM) model to develop technical, economic, and market savings potentials. The model is a Microsoft Excel® spreadsheet consisting of 30 worksheets containing model inputs, calculations, and outputs. The model estimates energy savings potential for residential, commercial, and industrial sectors.

The technical and economic savings potentials produced by the model differed significantly from the potentials developed in 2007. Technical and economic savings potentials were much higher with the CalEERAM model, to an extent not sufficiently explained by changes to either technologies or measure costs. The different results probably stem from different model assumptions. The 2007 model was not available for review, however, so a detailed comparison of the two models was not possible.

CalEERAM uses load forecasts supplied by the utilities. For the largest POU's, the utilities filed these forecasts with the Energy Commission for the 2009 *Integrated Energy Policy Report (IEPR)* to determine the base forecast for years 2010-2020. The utilities filed this load forecast data in response to the Energy Commission's *Demand Forecast Forms and Instructions*.<sup>12</sup> The utilities

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<sup>12</sup> *Forms and Instructions for Electricity Demand Forecasts*, Prepared in support of the 2009 *Integrated Energy Policy Report*, Energy Commission Report, CEC-100-2008-011-CMF, December 2008.

meant submitted load forecast to be the most likely projection of “unmanaged” total consumption. Unmanaged consumption means that the forecast does not include energy efficiency beyond “committed” resources, meaning established program budgets and staffing. In the 2009 IEPR demand forecast, committed efficiency for the POU included only the savings target for year 2009 since POU efficiency funding is generally budgeted only one year in advance.

This report examines the results of the CMUA group at two levels. First, in Chapter 4, the authors compare and analyze models targets and potentials of all 36 utilities without either examination or discussion of underlying. In Chapter 5, KEMA examines in detail the models of 12 of California’s largest POUs. After LADWP and SMUD, these 12 POUs had the highest program savings in 2008 and 2009. Their savings represent about 90 percent of POU fiscal year 2008/2009 net savings, excluding LADWP and SMUD, and 29 percent including those two large utilities. These 12 utilities provided their CalEERAM models to the Energy Commission, and KEMA evaluated the model structure and assumptions to learn what factors were driving the utilities’ savings potentials and targets. Detailed discussions for each of these 12 utilities appear in Chapter 6.

## SMUD

Itron conducted SMUD’s most recent potential study, completed in 2006.<sup>13</sup> SMUD subsequently submitted revised savings targets to the Energy Commission. Because SMUD does not have updated potentials, it is discussed only briefly in this review to help provide a complete picture of California’s POUs.

## LADWP

LADWP’s most recent potential study is still pending and the Energy Commission had not received its revised targets. Until the Energy Commission receives those updated targets, LADWP’s 2007 targets remain in effect. LADWP is therefore discussed only briefly in this review to help provide a complete picture of the California POUs.

## Sources of Potentials and Targets

KEMA’s review of potentials and targets addressed a number of data sources and models, including:

- *Establishing Energy Efficiency Targets: A Public Power Response to AB2021. Final Update.* (CMUA 2007).
- CMUA’s March 2010 SB 1037, report *Energy Efficiency in California’s Public Power Sector: A Status Report.*

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13 Itron, 2006. *Energy Efficiency Potential Study*. Prepared for SMUD.

- CalEERAM models (received July 2010) for Anaheim, Banning, Burbank, Glendale, Imperial Irrigation District, Modesto, Palo Alto, Pasadena, Riverside, Roseville, Silicon Valley Power, Truckee, and Turlock Irrigation District.
- Revised CalEERAM models (received October 2010) for Anaheim, Burbank, Glendale, Imperial Irrigation District, Modesto, Palo Alto, Pasadena, Riverside, Roseville, Silicon Valley Power, and Turlock Irrigation District. These revisions are discussed in detail below.

Because KEMA's analysis consisted of two versions of the CalEERAM models and up to three sets of CalEERAM outputs, the discussion of targets and potentials can be confusing. **Table 4** shows a timeline that describes the process of model updates and target adoptions.

**Table 4: Timeline for Model Updates and Target Adoption**

<b>Time Period</b>	<b>Event</b>
Late 2009 - Early 2010	POUs develop CalEERAM models.
March 2010	CMUA publishes technical, economic, and market savings potentials and savings targets for 36 POU.
Spring 2010	Utilities' targets are approved and adopted by their respective governing boards.
July 2010	KEMA receives CalEERAM models from 12 of the largest utilities in the CMUA group.
August 2010	KEMA identifies key data error affecting most of the utilities' models (see discussion below).
October 2010	Utilities provide corrected CalEERAM models for 11 of the largest utilities.
October 2010	CEC and POU agree that previously set targets will remain the official targets.

Because the POU did not update their targets after they corrected their CalEERAM models, this report draws its targets and potentials from different sources. Some information was available for 12 of the largest utilities but not for the smaller POU. The following bullets describe the sources key data referred to in this report:

- CMUA's March 2010 report is the source of the targets discussed in this report.
- The October 2010 revised models are the source of the technical, economic, and market savings potentials for the 12 POU studied, except for Truckee.
- The July model is the source of Truckee's technical, economic, and market savings potentials since it did not provide a revised model in October 2010.
- The March 2010 report is the source of the technical, economic, and market savings potentials for the smaller POU because their CalEERAM models revised or otherwise, were not available for review.

## Model Revisions

KEMA found that many of the 12 utility models received from the utilities in July showed different market savings potentials from those published in CMUA's March 2010 report; this

suggests that the POU's continued to revise their models after CMUA published the report. Then, during the review process, KEMA identified an error that affected most of the CalEERAM models provided to KEMA in July 2010. That error led to additional model revisions.

The CalEERAM model takes its measure input data (such as measure costs and savings) from a spreadsheet model called the E3 Reporting Tool, which E3 designed to report the results of utility energy efficiency programs. In reviewing the models, KEMA found that for most of the utilities, the analysis of some of the nonresidential building types pulled measure data for the wrong building type from the E3 Tool because of incorrect cell references in the models. For example, the Anaheim model analyzed offices, retail, lodging, and miscellaneous buildings. While offices and miscellaneous buildings used the correct data for those building types, retail and lodging did not. Calculations for retail buildings incorrectly used data for health buildings, while lodging used data for food stores. The authors found that while the building types analyzed in the model changed for each utility, the measure data inputs did not. In all cases, the measure savings and cost data used were for office, health, food store, and miscellaneous for building types 1, 2, 3, and 4, respectively. Of the 12 utilities studied in detail, only Palo Alto used the correct data for all four commercial building types.

KEMA found it was not possible to determine to what extent the error drove differences in technical, economic, and market savings potential results across utilities, as opposed to differences in assumptions, inputs, or climates specific to the POU analyzed. The Energy Commission therefore requested that the utilities develop and provide corrected versions of the model. KEMA received 11 revised models in October 2010. Truckee did not provide a revised model, and all potentials reported for Truckee in this report are from the uncorrected model, which the utility delivered to KEMA in July 2010.

The revised market savings potentials differ from the market savings potentials from the July models for all the utilities.

**Figure 4** compares the market savings potentials published in the CMUA March 2010 report with the market savings potentials from both the models received in July 2010 and from the revised models received in October 2010.

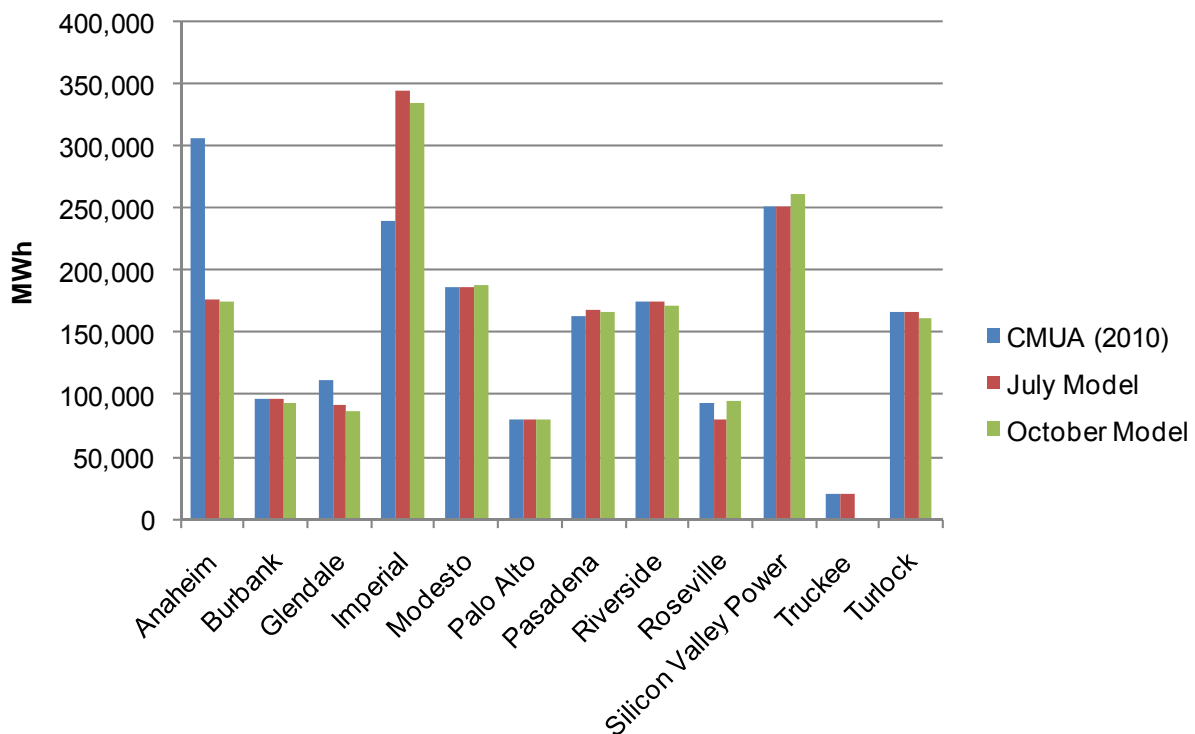
Between the CMUA March report and the models received in July, only seven utilities had no change to market savings potential. The changes to Anaheim and Imperial were particularly large; Anaheim's cumulative market savings potential decreased by 43 percent and Imperial's increased by 43 percent. Glendale decreased by 19 percent, Roseville decreased by 15 percent, and Pasadena increased by about 3 percent. The models submitted to the Energy Commission by these 5 utilities did not document the potentials and targets in the March report, but rather reflected later changes and updates to the model. One of the goals of this report is to explain the differences in potentials and targets among the utilities; large differences between the available models and the March potentials and targets made that process difficult.

On average, revisions due to the correction of the model error produced much smaller changes. All 11 POU's with revised models showed changes to market savings potential; of those, 4 had a

change of less than 1 percent between the July and October versions. The largest change was to Roseville, which had an 18 percent increase that almost perfectly offset the decrease between the March report and the July version of the model. Turlock, Silicon Valley Power, Riverside, Imperial, Glendale, and Burbank had changes of between 1 percent and 6 percent.

**Table 5** summarizes the overall change in potentials between the CMUA March 2010 report and the October revised models.

**Figure 4: Comparison of Cumulative 2011-2020 Market Potential for Different Versions of the CalEERAM Model**



Note: Truckee did not supply a revised model in October.

Source: California Municipal Utilities Association, *Energy Efficiency in California's Public Power Sector. A Status Report*, March 2011. California Energy Efficiency Resource Assessment Models, October 2010 and July 2010 versions.

**Table 5: Effect of Data Errors on Market Potential in CalEERAM Model Runs**

	March 2010 Reported Market Savings Potential and Targets	October 2010 Market Savings Potential After Correction of Data Errors
<b>Anaheim</b>	Targets same as market savings potential	The cumulative was 43% lower than in March.
<b>Burbank</b>	Targets same as market savings potential	The cumulative was 3.5% lower than in March.
<b>Glendale</b>	Glendale adopted targets of 1 percent of energy use each year in the CMUA March 2010 report, which is higher	The cumulative revised market savings potential was 23% lower than the cumulative March market

	than its market savings potential in some years and lower in others. In spite of the different shape to the curve, its cumulative target is very close to its cumulative market savings potential.	savings potential and 25% lower than the utility's cumulative approved targets.
<b>Imperial</b>	Targets same as market savings potential	The cumulative was 40% higher than in March.
<b>Modesto</b>	Targets same as market savings potential	The cumulative was 0.6% higher than in March.
<b>Palo Alto</b>	Utility-adopted targets in the CMUA March 2010 report were lower than its market savings potential. Its cumulative targets are about 7 percent lower than its cumulative market savings potential.	The cumulative revised market savings potential was 0.1% lower than the cumulative March market savings potential and 7.9% higher than the utility's cumulative approved targets
<b>Pasadena</b>	Pasadena adopted stair-step targets that somewhat flatten the market savings potentials. In spite of the different shape to the curve, its cumulative target is very close to its cumulative market savings potential.	The cumulative revised market savings potential was 2.2% higher than the cumulative March market savings potential and 0.1% higher than the utility's cumulative approved targets.
<b>Riverside</b>	Targets same as market savings potential	The cumulative was 1.7% lower than in March.
<b>Roseville</b>	Targets same as market savings potential	The cumulative was 0.4% higher than in March.
<b>Silicon Valley</b>	Targets same as market savings potential	The cumulative was 4.1% higher than in March.
<b>Truckee</b>	Truckee's targets are flatter than its market savings potential, higher in some years and lower in others. In spite of the different shape to the curve, its cumulative target is very close to its cumulative market savings potential.	The cumulative revised market savings potential from the July model was equal to the cumulative March market savings potential and the utility's cumulative approved targets. Truckee did not submit a revised model in October.
<b>Turlock</b>	Targets same as market savings potential	The cumulative was 2.7% lower than in March.

Source: Data obtained from California Municipal Utilities Association, *Energy Efficiency in California's Public Power Sector. A Status Report*, March 2010 and California Energy Efficiency Resource Assessment Models (October 2010).

## Approach for Assessing Utility Potentials and Targets across All Utilities

Limited data were available for the smaller POU's. While 12 of the larger POU's submitted copies of completed CalEERAM models, the CEC did not request this of the smaller POU's. The CMUA March 2010 report included CalEERAM model outputs for 36 utilities. These results included megawatt-hour (MWh) targets, targets as a percentage of load forecast, and technical, economic,

and market energy and demand savings potential by sector. The assessors combined these with the corresponding results of the revised models for the 11 utilities, as discussed above.

The assessment across all utilities encompassed the following items:

- **Adopted Targets** – What is the range and size of the targets adopted by the utilities? How much of the load forecast do the targets capture? How do the targets relate to the market and economic savings potentials for each utility? How quickly do the targets ramp up? How do the new targets compare with the previous targets adopted in 2007?
- **Market Potential Savings** – What is the trend in market savings potentials, as estimated by the utilities? Are market savings potentials comparable between utilities? How do estimated program costs per kilowatt-hour (kWh) compare?
- **Technical and Economic Potential Savings** – How do technical and economic savings potentials compare across utilities? How do those technical and economic savings potentials change over time, compared with utility load forecasts? How do the potentials compare with the previous 2007 potential estimates?

Chapter 4 presents the results of this assessment.

## Approach for Assessing 12 of the Larger Utilities

KEMA developed two frameworks to evaluate the POU models. The first focused on the general structure of the model, and the second focused on the inputs, assumptions, and outputs specific to each utility. Reviewers familiar with potential models completed the frameworks. KEMA used the first framework to assess Anaheim's CalEERAM model as a representative of the model structure.<sup>14</sup> The reviewers applied the second framework to each of the 12 utilities. Appendix B presents the complete evaluation frameworks.

### Evaluation Frameworks

The first framework, focusing on model structure and capabilities, examined the following items:

- **Reporting/documentation adequacy** —is the model adequately documented.
- **Model approach**—is the model a bottom-up or top-down model? Is the approach reasonable? Is it robust?
- **Model capabilities**—what types of energy saving potentials are calculated? Does the model calculate naturally occurring savings?
- **Baseline energy use**—does the model incorporate a baseline energy analysis?

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<sup>14</sup> The application of the second (POU-specific) framework found few differences in how the model was applied across utilities, so the results of the first framework were not affected by the individual utilities.

- **Technical savings potential**—how are energy savings shown? Does the model incorporate dynamic elements? How does the model deal with the possibility of double-counting multiple or competing measures? How does the model address codes and standards?
- **Economic savings potential**—what cost-effectiveness test is used to screen measures? What other cost-effectiveness measures are calculated?
- **Market (budget constrained) potential**—how is market penetration determined? How flexible is the model with respect to different levels of incentives or customer awareness? How does the model deal with naturally occurring savings? Can the model evaluate alternate avoided cost or program scenarios? How are program costs determined? Is the stock accounting correct for new construction, retrofit, and replace-on-burnout measures? Is the building stock forecast consistent with load growth?
- **Consistency with other studies**—is the method consistent with that of other POU's and investor-owned utilities (IOUs) in California.

The second framework focused on how each POU applied the CalEERAM model. KEMA evaluated the POU's CalEERAM models based on the following criteria:

- **Reporting/documentation adequacy**—are data sources provided for all inputs? Does the report documenting the model provide key input data?
- **Customer disaggregation**—to what extent does the model disaggregate customers by sector, building type, and new or existing construction?
- **Measure list**—which end use categories are included in the measure list? How many measures are included? Does the measure list cover most of the available energy efficiency opportunities? Does the measure list include emerging technologies?
- **Measure cost inputs**—what is the source of measure costs? Are these costs reliable? Are full and incremental cost used appropriately for the type of measure? Do measure costs appropriately align with measure savings?
- **Measure savings inputs**—what the source of measure savings is. Are the savings reliable? Are savings for weather-sensitive measures appropriate to the utility's climate zone? Are the effects of codes and standards on measure savings appropriately modeled? Are peak demand savings consistent with energy savings? Are measure savings consistent with baseline energy use? Are the implied percentage savings reasonable?
- **Measure life inputs**—what the source of measure life inputs is. Are the lifetimes reliable? Are lifetimes for early replacement measures appropriate?
- **Measure applicability and implementation inputs**—Are the measures applied to the correct share of the population? Are market penetration levels differentiated by measures? Are they reasonable? How does the model estimate free ridership? Are net-to-gross ratios reasonable?
- **Consistency with utility energy use forecast**—Are the bottom-up estimates of energy use and savings by sector and building type consistent with overall electricity use. Was the model calibrated at this level?

- **Interactive effects**—Are indirect energy effects (for example, windows intended to reduce cooling loads through reduced solar heat gain also increase heating costs) accounted for? Does the model include bundles of measures?
- **Other inputs**—KEMA compared key inputs across models including rates, avoided costs, discount rates, inflation rates, and line-loss rates.
- **New construction**—Are rates of new construction and existing building decay consistent with the load forecast?
- **Outputs**—KEMA compared key outputs across models, including program ramp-up and program costs per unit savings.
- **Consistency with other studies**—Are measure inputs consistent across the POU, especially avoided costs? Are incentive scenarios consistent across POU?
- **Consistency with previous potential estimates**—Are the potential estimates consistent with those developed by POU in 2007.

Chapter 6 presents the results from the application of these frameworks to the POU's CalEERAM models.

## Individual Utility Results

In addition to the high-level comparison of POU potentials and targets, this report also examines individual CalEERAM inputs, potential results, and targets for 12 of the larger utilities that provided completed CalEERAM models. The POU used these models to assess the annual and cumulative targets versus the 2010 CMUA report that analysts used to assess the targets for the smaller utilities.

For each utility, the report compares targets with recorded savings. What is their record of accomplishment, and does it appear sustainable? What is their record of reliably achieving their savings targets? Overall, the report provides the target assessments in accordance with criteria set out in AB 2021, specifically:

- Are they cost-effective?
- Are they feasible?
- Are they reliable?
- Do they meet the energy reduction goal set out in the legislation?

## CHAPTER 3: Assessing Utility Potentials and Targets across All Utilities

This chapter compares targets and potentials across utilities. The following section discusses the potentials and targets for the CMUA group. A separate section presents SMUD's and LADWP's targets and compares targets across all the utilities.

### Comparison of Potentials and Targets

The following sections present the outputs of the CalEERAM models. The CMUA's March 2010 report is the source of targets as well as potentials for Truckee and the remaining 24 utilities. The October 2010 revised models are the source of potentials for 11 of the POUs studied in detail. This section includes comparisons of technical and economic savings potential savings, market savings potentials, and targets.

#### Technical and Economic Potential Savings

Technical savings potential is defined as the complete penetration of all measures analyzed in applications where they were deemed technically feasible from an engineering perspective. It is not usually associated with a period and is calculated as if all possible measures could be installed instantaneously. Economic savings potential refers to the technical savings potential of only the energy efficiency measures that are cost effective when compared with supply-side alternatives, based on a cost effectiveness test, which is usually the TRC test. Like technical savings potential, it is usually instantaneous and not associated with a particular time frame.

**Figure 5** compares technical and economic savings potentials across the 36 utilities. The chart on the left shows technical and economic savings potential as a percentage of each utility's energy use. Technical savings potential varies widely, from 11 percent to 66 percent, averaging 33 percent of base energy use. Most of the utilities showed technical savings potential of between 25 and 50 percent of energy use. By comparison, the 2008 California investor-owned utility (IOU) potential study<sup>15</sup> estimated technical savings potential for the IOUs to be 22 percent of base energy use.

The economic energy savings potential estimated for the POUs in the 2010 study averaged 29 percent of base energy use. This is higher than the economic savings potential estimated for the IOUs in their 2008 potential study, which was 19 percent of base energy use.

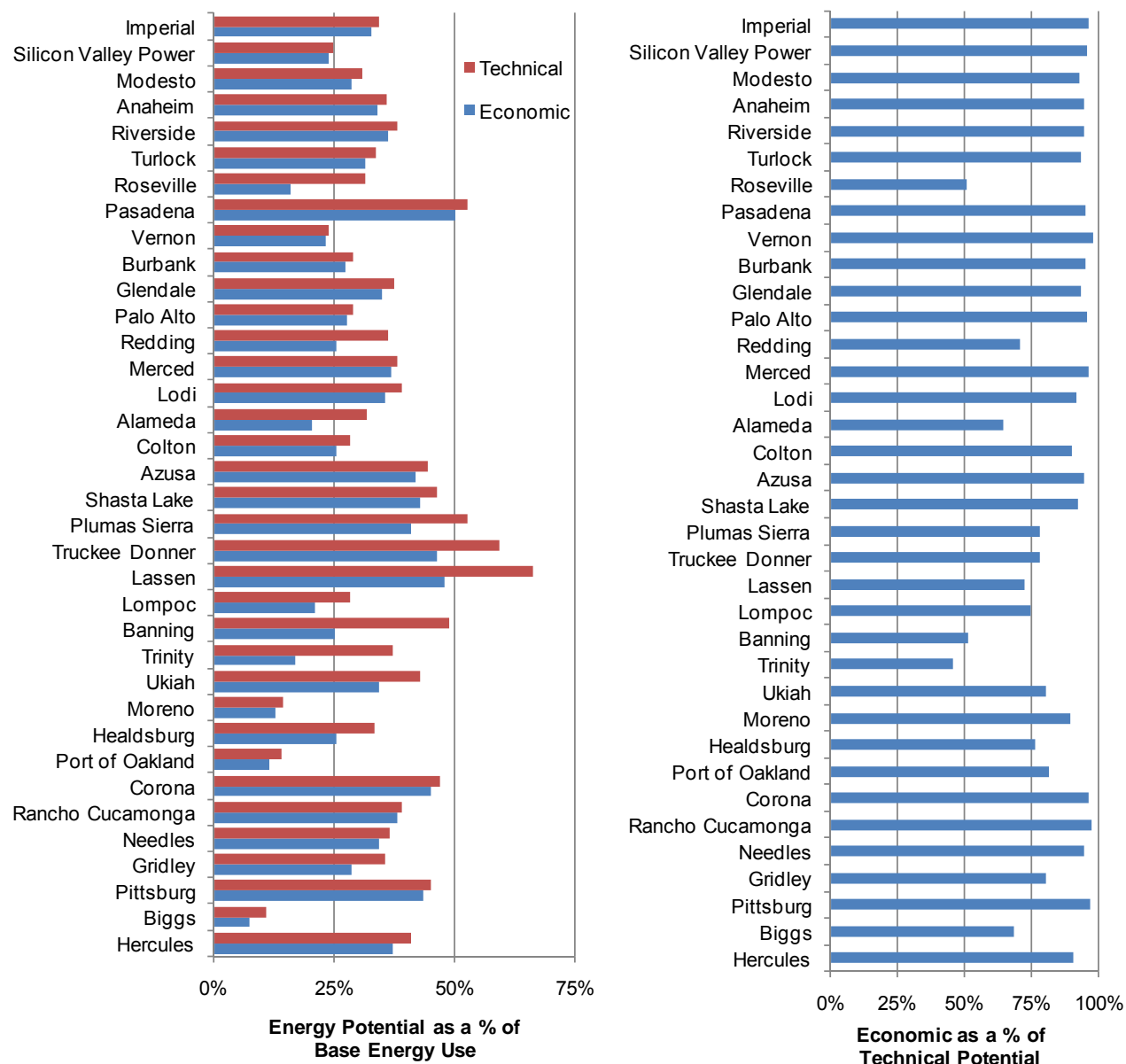
The chart on the right in **Figure 5** shows economic savings potential as a percentage of technical savings potential. The choice of measure list and how many measures are either not cost effective or cost effective in only a small subset of homes or buildings strongly affects this metric. Including more such measures will result in higher technical savings potential as

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15 Itron, 2008. *California Energy Efficiency Potential Study*. Prepared for PG&E on behalf of California IOUs.

compared with economic savings potential. Variations in measure savings, for example due to climate variation, can affect cost-effectiveness and this metric as well.

**Figure 5: Technical and Economic Potential in 2011 as a Percentage of Energy Use, and Economic Potential as a Percent of Technical, by Utility**



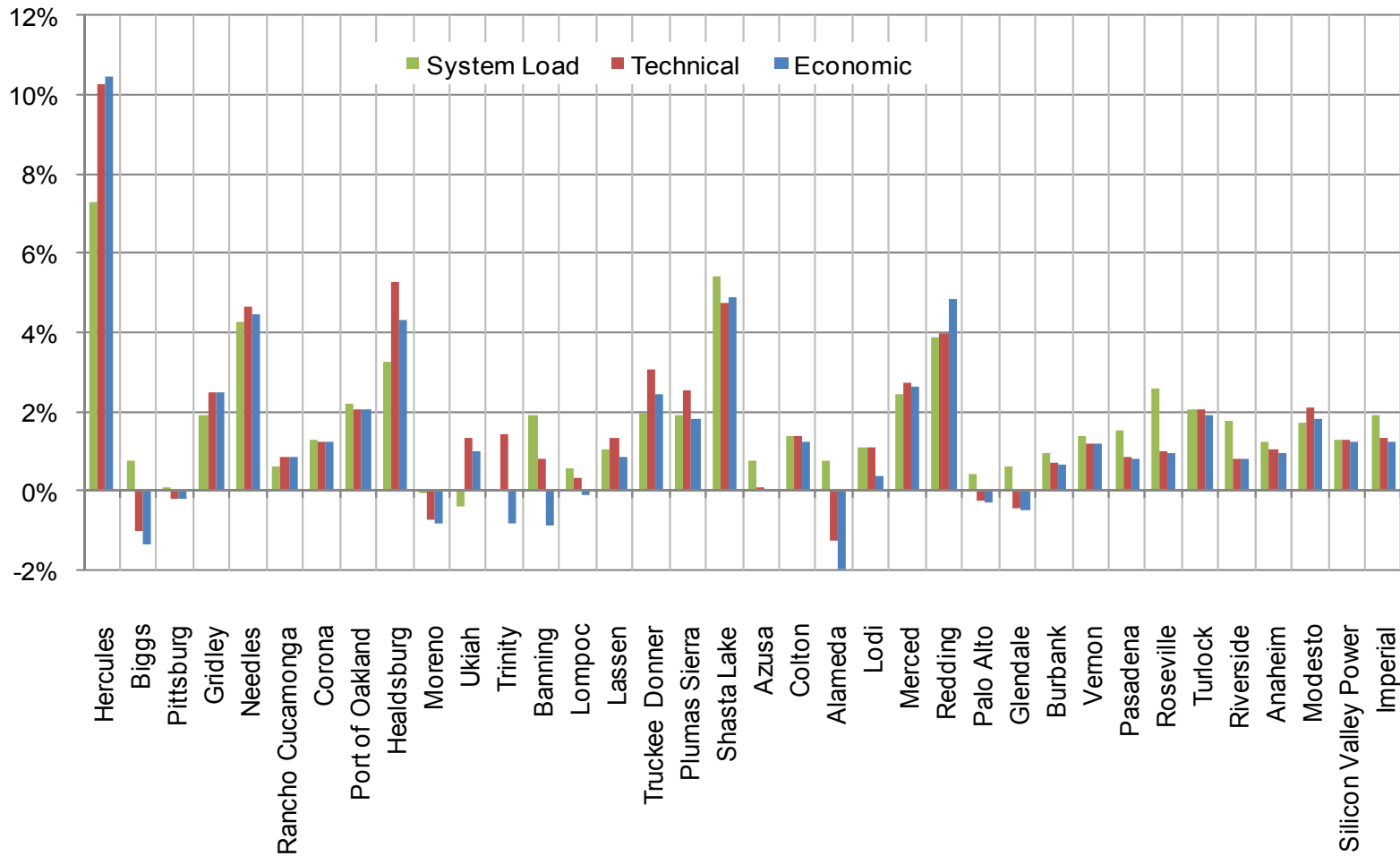
Source: Data obtained from California Municipal Utilities Association, *Energy Efficiency in California's Public Power Sector. A Status Report*, March 2010 for 25 utilities, combined with California Energy Efficiency Resource Assessment Models (October 2010) for 11 utilities.

More than half of the utilities have economic savings potentials greater than 90 percent of their technical savings potentials. Two-thirds have economic savings potential greater than 80 percent of technical savings potential. Trinity, Banning, Roseville, Alameda, Biggs, Lassen, Lompoc, Healdsburg, Truckee, Plumas Sierra, Redding, and Ukiah all have economic savings potential below 80 percent of their respective technical savings potentials. Chapter 4 will study Roseville and Truckee in greater detail to explain their low values.

**Figure 6** shows how estimates of technical and economic savings potential change over time, as compared with changes to each utility's load forecast. Hercules has the highest rate of growth, with energy use expected to more than double between 2011 and 2020. Other utilities with high growth rates are Needles, Healdsburg, Shasta Lake, and Redding. For most utilities, technical and economic savings potentials increase only slightly faster or slower than their base energy use. Given the structure of the model, changes to the building stock over time are the primary drivers of changes to technical and economic savings potential, with some additional effects from efficiency standards. These factors as well as energy intensity (how much electricity is used per home or per square foot of nonresidential buildings) drive changes in system load. For most of the utilities, growth in potential is only slightly higher or lower than growth in their respective system loads. Where there is a large difference, it may indicate that the building stock forecast and the load forecast are not related to one another, which could result in potentials being either understated or overstated.

Trinity and Banning show a particularly puzzling result: Technical savings potential is increasing over time while economic savings potential is decreasing. The model incorporates few dynamic elements that would explain this result. The only factor that changes measure savings over time is the efficiency standards for screw-based lighting, which affects compact fluorescent lighting (CFL) measures. If CFL savings dominate economic savings potential for these utilities, it could explain this result. (KEMA could not explore this issue further because detailed data was not available from these utilities.)

**Figure 6: Average Annualized Percentage Change in System Load and in Technical and Economic Potential, 2011-2020**



Source: Data obtained from California Municipal Utilities Association, *Energy Efficiency in California's Public Power Sector. A Status Report*, March 2010 for 25 utilities, combined with California Energy Efficiency Resource Assessment Models (October 2010) for 11 utilities.

**Figure 7** compares the technical savings potentials estimated in 2010 to 2007 estimates. (The chart compares the potentials for 2011 from each forecast.) Almost all the utilities showed a sharp increase in estimated technical savings potential between the two studies. Only Biggs and Moreno showed a decrease in potential (31 percent and 21 percent, respectively). Port of Oakland showed only a slight increase of 17 percent. Technical savings potential estimates for Lassen, Truckee, and Pittsburg quadrupled. Economic savings potentials showed a similar pattern of change between the 2007 and 2010 assessments.

**Table 6** shows the energy efficiency potentials estimated for the CMUA group in 2010, compared with the potentials estimated in 2007. The technical energy savings potential is estimated at 10,693 per GWh in 2020. This is 96 percent higher than the 2007 estimate of technical savings potential estimated for 2016 for these same utilities. Technical savings potential for demand reductions is 2,861 megawatts (MWs) in 2020, which is almost four times higher than the 2007 estimate for 2016.

**Table 6: Estimated Potentials for CMUA Group**

	Energy Savings Potentials – GWh			Demand Savings Potentials – MW		
	Technical	Economic	Market	Technical	Economic	Market
Current Analysis (2010), 2011-2020	10,693	9,525	2,143	2,861	2,283	526
Previous Analysis (2007), 2007-2016	5,460	4,038	2,109	732	507	302

Source: Data from 2010 obtained from California Municipal Utilities Association, *Energy Efficiency in California's Public Power Sector: A Status Report*, March 2010 for 25 utilities, combined with California Energy Efficiency Resource Assessment Models (October 2010) for 11 utilities. Data from 2007 obtained from California Municipal Utilities Association, *Establishing Energy Efficiency Targets: A Public Power Response to AB2021. Final Update*, October 2007.

The 2010 study estimates energy savings potential for the POUs to be 9,525 GWh in 2020. This estimate of economic savings potential is 136 percent higher than the 2007 estimate of economic savings potential in 2016 for these same utilities. The 2010 estimate for economic demand savings potential is 2,283 MW in 2020, which is more than four times higher than the 2007 estimate for 2016.

For the CMUA group, the cumulative market energy savings potential through 2020 was an estimated 2,143 GWh, which is slightly higher than the 10-year market savings potential estimated for the same utilities in 2007. The 2010 estimate for market demand savings potential is 526 MW in 2020, which is 74 percent higher than the 2007 estimate for 2016.

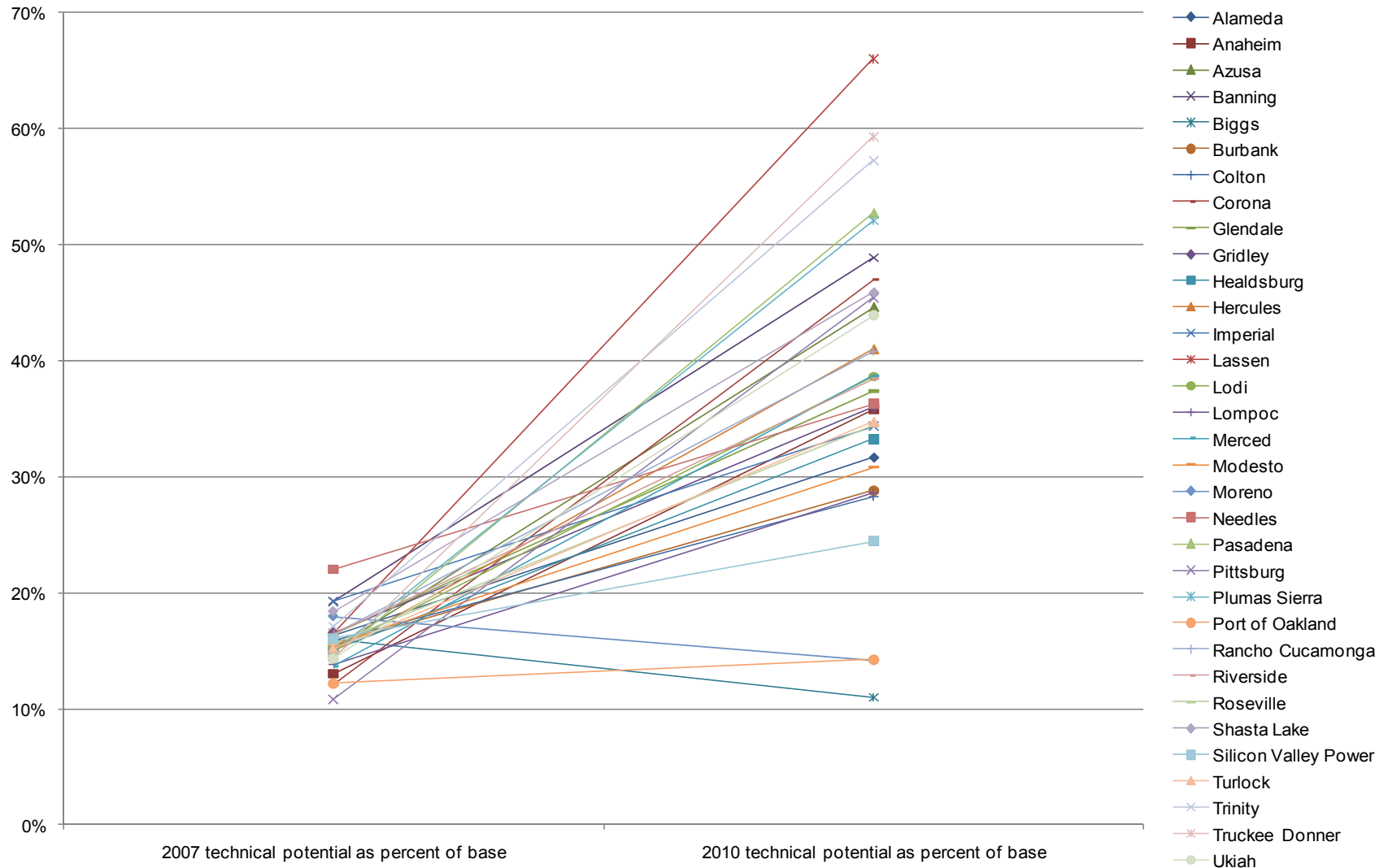
KEMA cannot fully explain these changes to potential with the information available for this study. KEMA believes that rather than an actual change in potential, a more comprehensive and detailed modeling approach is responsible for the marked increase. The 2007 study used a top-down modeling approach, which combined potential estimates from another study<sup>16</sup> with information on POU energy use and number of customers. The 2010 model is a bottom-up

<sup>16</sup> 2006 California Energy Efficiency Potential Study. Prepared by Itron for Pacific Gas and Electric, Southern California Edison, and San Diego Gas & Electric.

model that builds up savings from assumptions about measure costs and savings, building stocks, equipment saturation, adoption patterns, codes and standards, and energy prices.

Interviews with POU representatives found that both the 2007 study and the 2010 study lacked credibility with utility program planners, in part due to the sharp change in potential estimates between the two studies. Several representatives expressed skepticism at the recommendations that came out of the 2007 potential study, which identified CFLs as the key source for savings. Few of the POUs interviewed indicated that they would apply the 2010 potential study results to their program planning.

**Figure 7: Change in Technical Potential From 2007 Estimates to 2010 Estimates (2011 Technical Potential)**

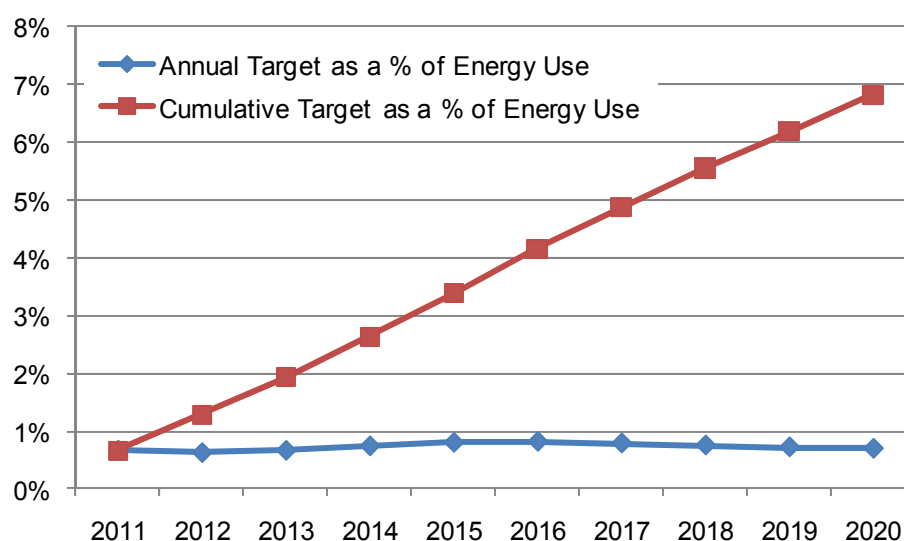


Source: Data from 2010 obtained from California Municipal Utilities Association, *Energy Efficiency in California's Public Power Sector. A Status Report*, March 2010 for 25 utilities, combined with California Energy Efficiency Resource Assessment Models (October 2010) for 11 utilities. Data from 2007 obtained from California Municipal Utilities Association, *Establishing Energy Efficiency Targets: A Public Power Response to AB2021. Final Update*. October 2007.

## Adopted Targets and Market Potentials

The energy reduction goal set forth in AB 2021 is 10 percent of base energy use over 10 years. **Figure 8** shows the aggregate annual and cumulative targets for the 36 utilities over time. Annual targets vary somewhat from year to year but never reach 1 percent of base energy use. The aggregated POU targets do not meet the AB 2021 requirement, reaching savings of 6.8 percent of forecasted 2020 base energy use. By comparison, the estimated 10-year market savings potentials for the IOUs range from 3 percent to 6 percent of electricity use.<sup>17</sup>

**Figure 8: Annual and Cumulative Targets as a Percentage of Energy Use**



Source: California Municipal Utilities Association, *Energy Efficiency in California's Public Power Sector. A Status Report*, March 2010.

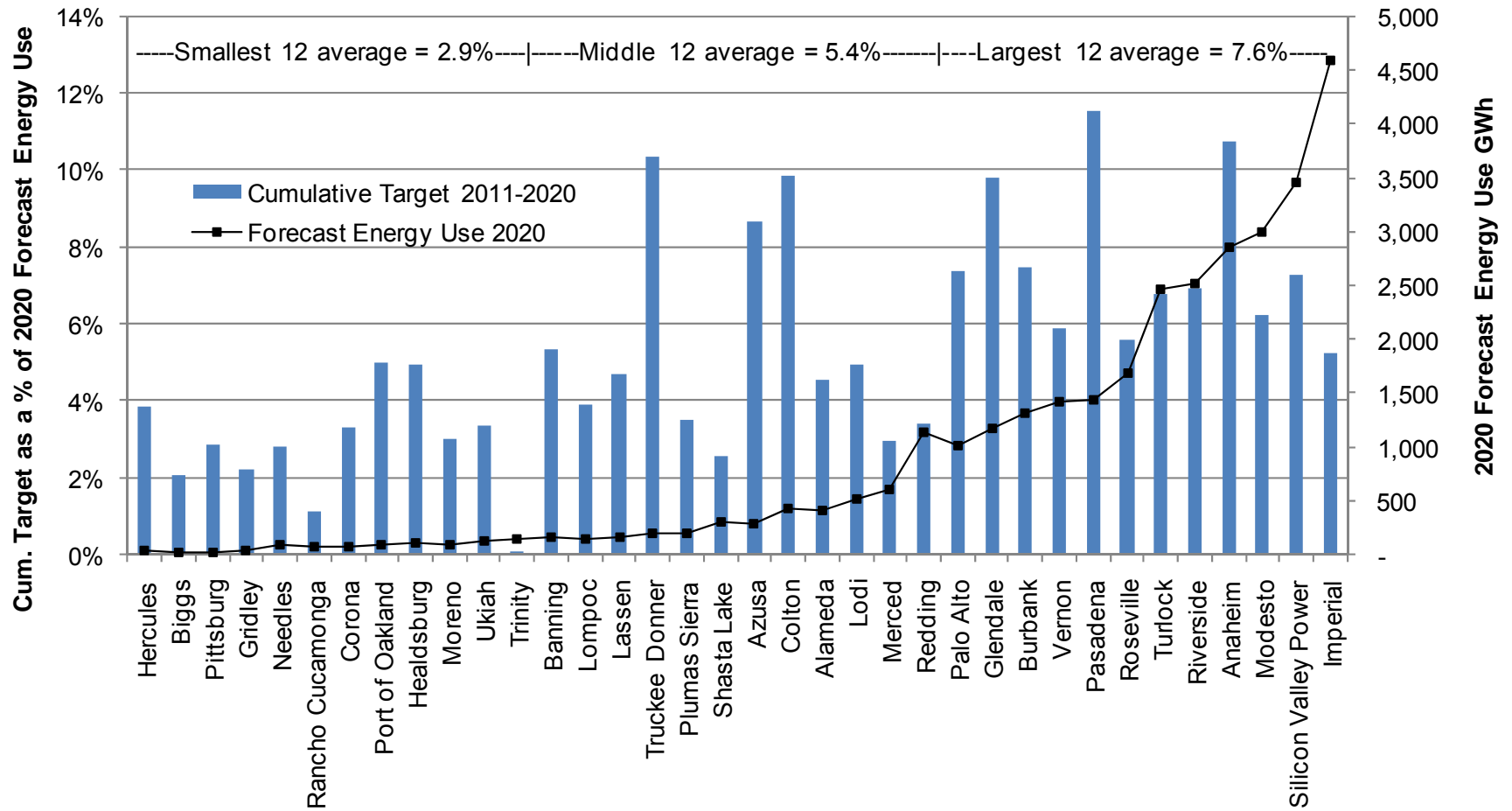
**Figure 9** shows 10-year cumulative targets by utility as a percentage of forecasted base energy use. The utilities are ranked by system load (smallest to largest), with system load plotted as a black line (values on secondary axis). While there is a great deal of individual variation, targets tend to be higher for the larger utilities and smaller for the smaller utilities. The average 10-year target for the 12 largest utilities was 7.6 percent, while the average for the 12 smallest was 2.9 percent. The mid-sized utilities had a mix of high and low targets and averaged 5.4 percent.

Only 3 of the evaluated utilities' targets meet the 10-percent-over-10-year goal of AB 2021: Pasadena, Anaheim, and Truckee. Glendale and Colton fall only slightly short, which could be due to a rounding error. (KEMA calculated base energy use from data in the CMUA March 2010 report, which the report rounded to the nearest integer.)

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<sup>17</sup> For the 2008 IOU study, three primary market savings potential scenarios were developed: a base scenario that mirrored 2004-2005 programs, a full incentive scenarios that assumes incentives cover 100 percent of incremental measure costs, and a mid scenario with incentives set halfway between those for the base and full scenarios.

Figure 9: 10-Year Cumulative Targets as Percentage of 2020 Energy Use, Ranked by 2011 Utility Energy Use



Source: Data obtained from California Municipal Utilities Association, *Energy Efficiency in California's Public Power Sector. A Status Report*, March 2010.

Twenty-four of the 36 utilities set targets equal to the market savings potentials published in CMUA's March 2010 report. This indicates that most utilities intended to set targets equal to their estimated market savings potentials. The remaining 12 utilities (Alameda, Glendale, Gridley, Healdsburg, Lassen, Palo Alto, Pasadena, Port of Oakland, Shasta Lake, Trinity, Truckee, and Ukiah) set targets that were different from their respective March 2010 market savings potentials.

For utilities with targets that are different from their market savings potentials, **Figure 10** and **Figure 11** compare the two for both larger and smaller utilities, respectively. All of the market savings potentials are from the CMUA March 2010 report, which shows the information available to the utilities when they set their respective targets.

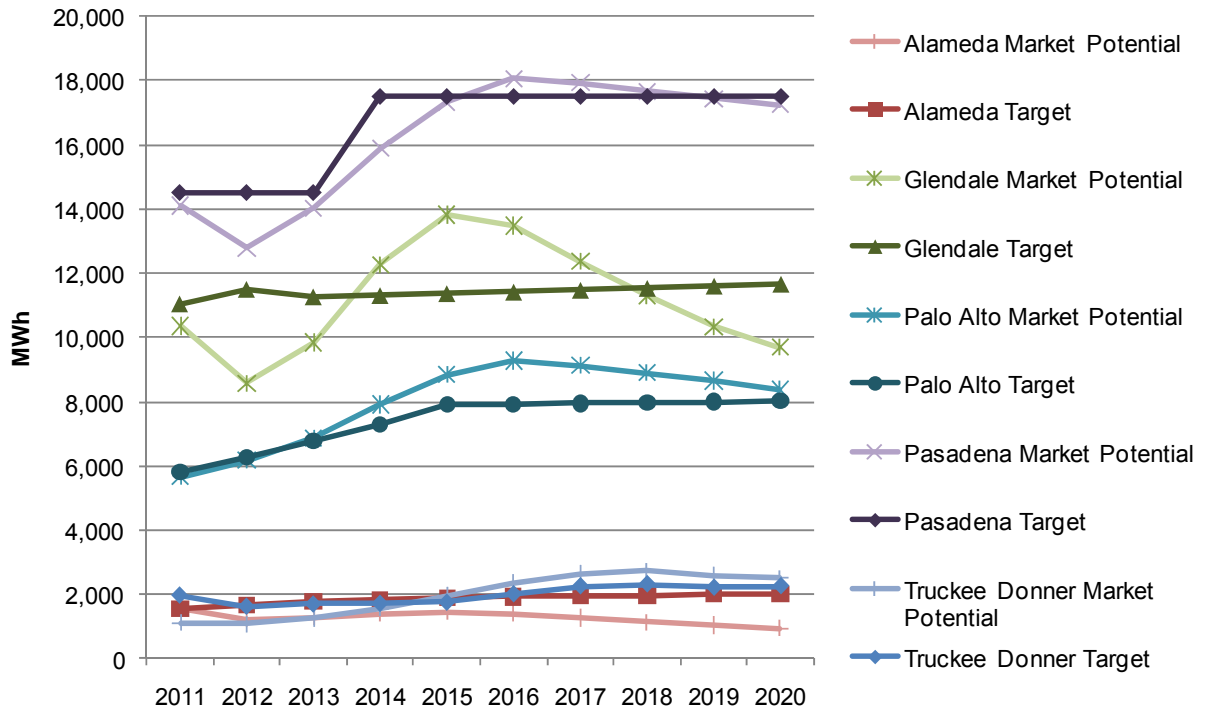
Glendale's and Truckee's targets are flatter than their market savings potentials, higher in some years and lower in others. (Glendale targeted 1 percent of energy use each year.) Shasta Lake's targets ramp up more steeply than its market savings potentials: they are lower in early years and higher in later years. Pasadena opted to adopt stair-step targets that somewhat flatten the market savings potentials. In spite of the different shape to the curve, the cumulative target for these utilities is very close to the cumulative market savings potential. The same is true for Gridley, Healdsburg, and Lassen.

Palo Alto, Ukiah, and Trinity all set targets lower than their market savings potentials. The cumulative targets for Trinity and Ukiah are much lower than their cumulative market savings potential (75 and 42 percent, respectively). Palo Alto's targets are only 7 percent lower, on a cumulative basis.

Alameda and Port of Oakland set targets higher than market savings potentials. Their cumulative targets exceed their cumulative market savings potentials by 45 percent and 114 percent, respectively.

Cumulative targets for all the POU's in aggregate for the 2011 to 2020 period are 2.8 percent higher than cumulative market potentials (2,204,908 MWh targets compared to 2,142,867 MWh market potentials).

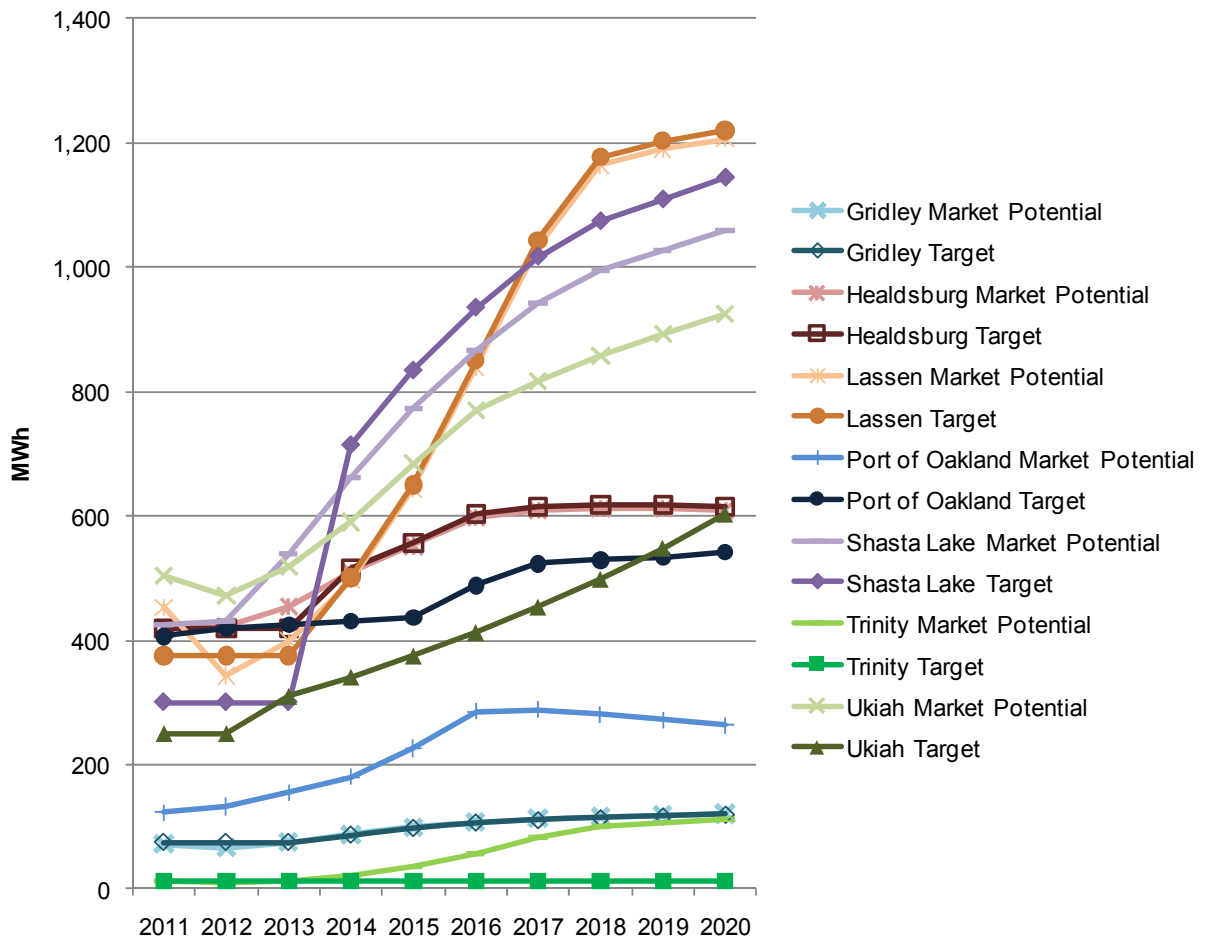
**Figure 10: Comparison of Targets and Market Potentials, Larger Utilities**



Note: This chart presents market savings potentials from the CMUA March 2010 report for all utilities, and illustrates the information available to those utilities at the time they set their targets. For Glendale, Palo Alto and Pasadena, these differ from the market savings potentials from the October 2010 revised model presented elsewhere in the report.

Source: Data obtained from California Municipal Utilities Association, *Energy Efficiency in California's Public Power Sector. A Status Report*, March 2010.

**Figure 11: Comparison of Targets and Market Potentials, Smaller Utilities**



Note: This chart presents market savings potentials from the CMUA March 2010 report for all utilities and illustrates the information available to those utilities at the time they set their targets.

Source: Data obtained from California Municipal Utilities Association, *Energy Efficiency in California's Public Power Sector. A Status Report*, March 2010.

**Table 7** shows POU potentials in 2020 by sector. The non-residential sector dominates the potentials and account for 74 percent of technical savings potential, 78 percent of economic savings potential, and 79 percent of market savings potential. This result shows that the POUs will need to focus significant program attention on their non-residential customers to achieve the higher levels of energy savings required to meet energy reduction goals.

**Table 7: Market Potential by Sector**

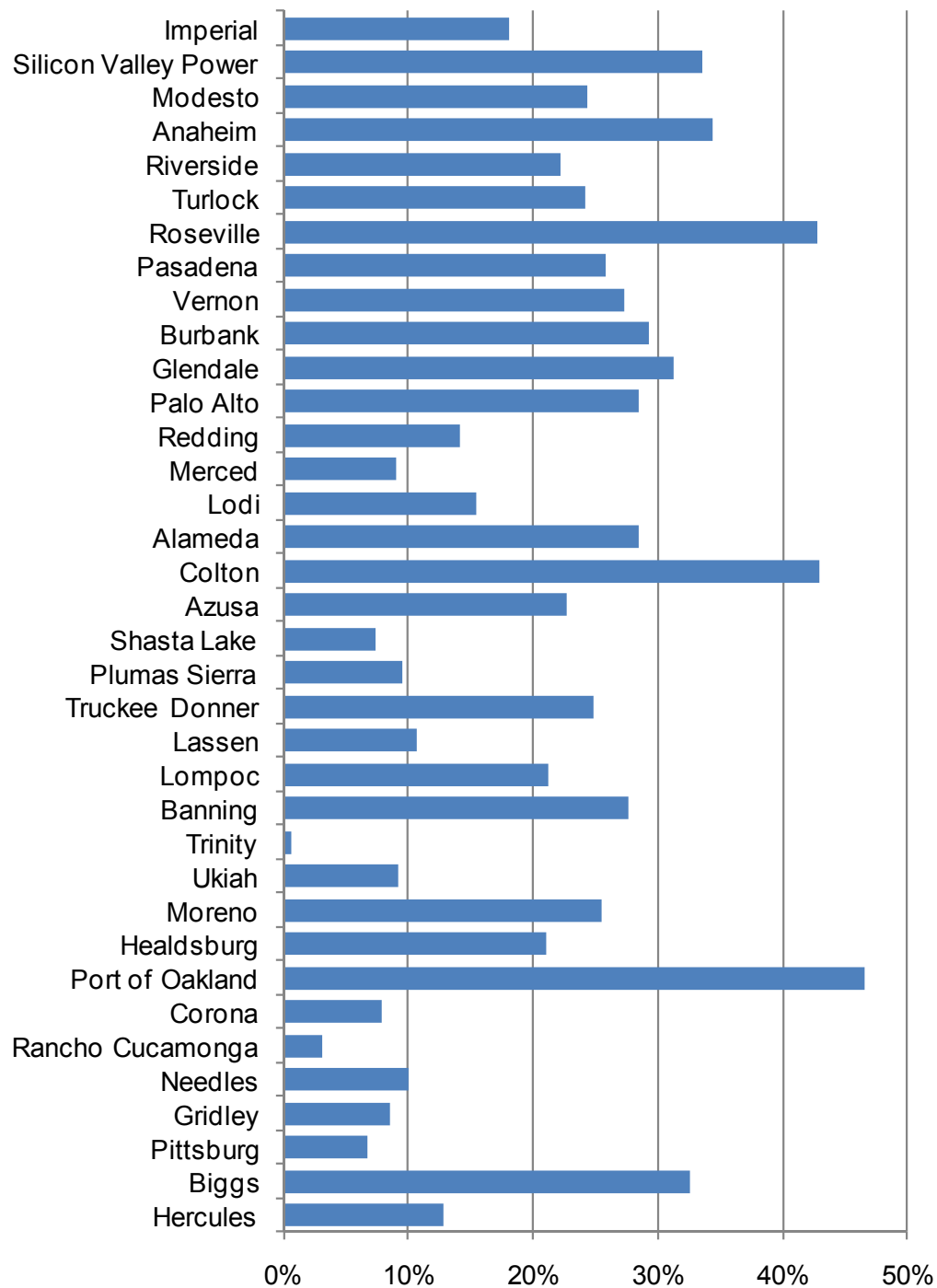
Sector	Energy Savings Potentials - GWh			Demand Savings Potentials - MW		
	Technical	Economic	Market	Technical	Economic	Market
Non-Residential	7,882	7,407	1,689	1,818	1,693	384

Residential	2,811	2,119	454	1,044	590	142
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Source: Data obtained from California Municipal Utilities Association, *Energy Efficiency in California's Public Power Sector. A Status Report*, March 2010 for 25 utilities, combined with California Energy Efficiency Resource Assessment Models (October 2010) for 11 utilities.

**Figure 12** shows targets as a percentage of economic savings potential. Roseville, Colton, and Port of Oakland have the highest targets as a percentage of economic savings potential, at more than 40 percent. As discussed later in the report, Roseville's economic savings potential may be artificially low (see discussion for **Table 13**), which would tend to decrease this percentage. The 12 largest POU's, with the exception of Imperial Irrigation District, have targets that exceed 20 percent of their respective economic savings potentials over 10 years. Alameda, Azusa, Truckee, Lompoc, Banning, Moreno, Healdsburg, and Biggs also exceed 20 percent of economic savings; 21 utilities beat that mark. At the other end of the spectrum, Trinity's targets capture less than 1 percent of economic savings potential over 10 years, and Rancho Cucamonga captures just 3 percent. By comparison, the estimated 10-year market savings potential for the investor-owned utilities ranged from 15 to 33 percent of economic savings potential.

**Figure 12: Cumulative Utility Targets 2011-2020 as a Percentage of Economic Potential**



Note: Utilities are ordered by system size (based on load).

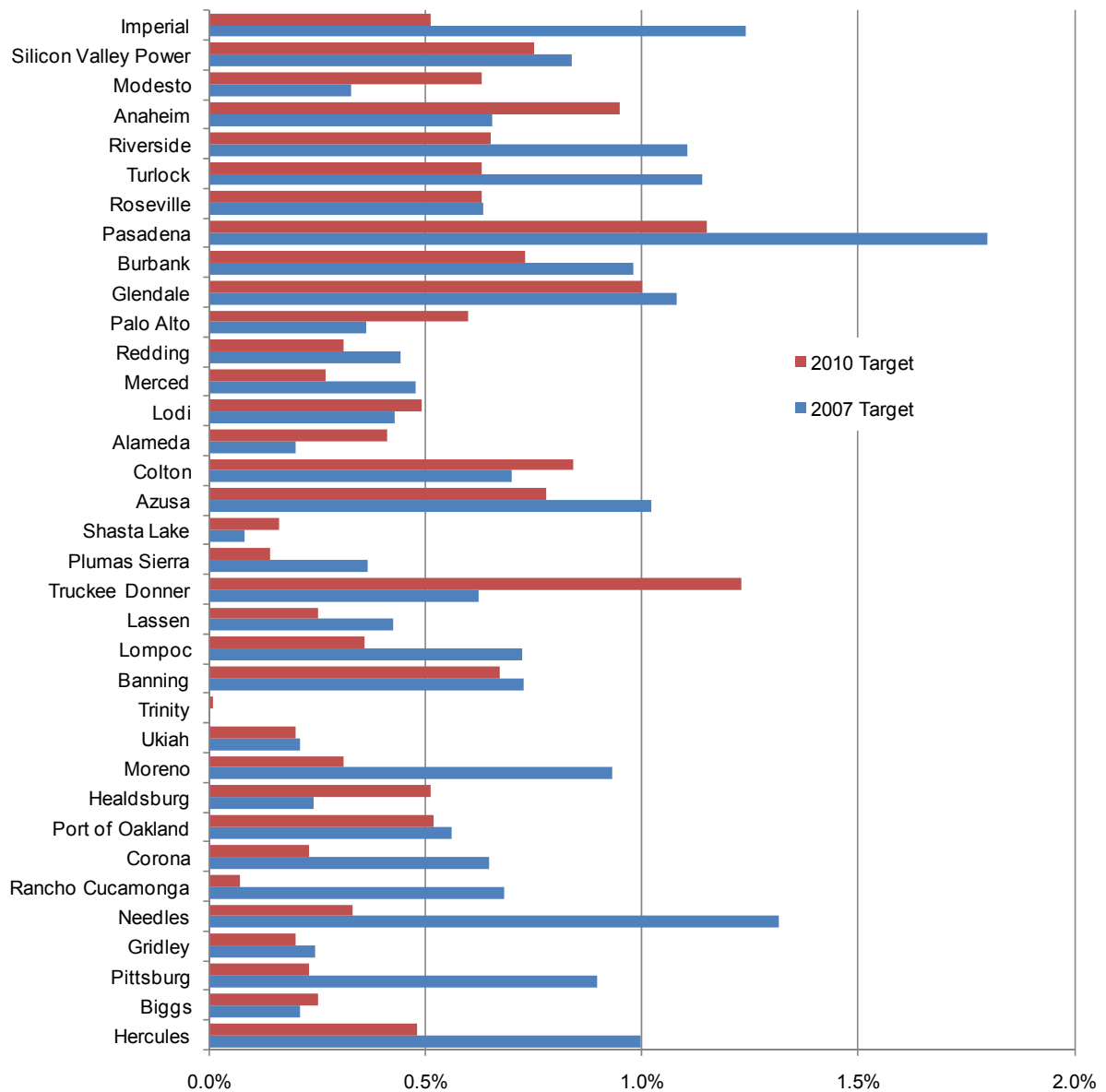
Source: Data obtained from California Municipal Utilities Association, *Energy Efficiency in California's Public Power Sector. A Status Report*, March 2010, combined with California Energy Efficiency Resource Assessment Models (October 2010) for 11 utilities.

**Figure 13** compares the targets set in 2010 to the targets set in 2007 for target year 2011, expressed as a percentage of 2011 energy use. Vernon did not set targets in 2007, so it is not included in the comparison. Of the remaining 35 utilities, only 11 increased their 2011 targets. Sixteen decreased their targets by 25 percent or more.

These were not small, incremental changes to targets. The magnitude of change for many of the utilities was quite large, with some increasing and some decreasing. In 2007, the POUs lacked experience in running efficiency programs. Three years of program experience may have allowed them to predict more accurately, what they can achieve through their programs. Adverse economic conditions have also caused some POUs to set lower targets.

**Figure 14** shows the relationship between 2011 targets and 2009 reported savings, expressed as a percentage of 2011 energy use. About half of the utilities set 2011 targets lower than their reported 2009 savings. While this assures that the targets are achievable, it may indicate that the targets are less aggressive than they could or should be.

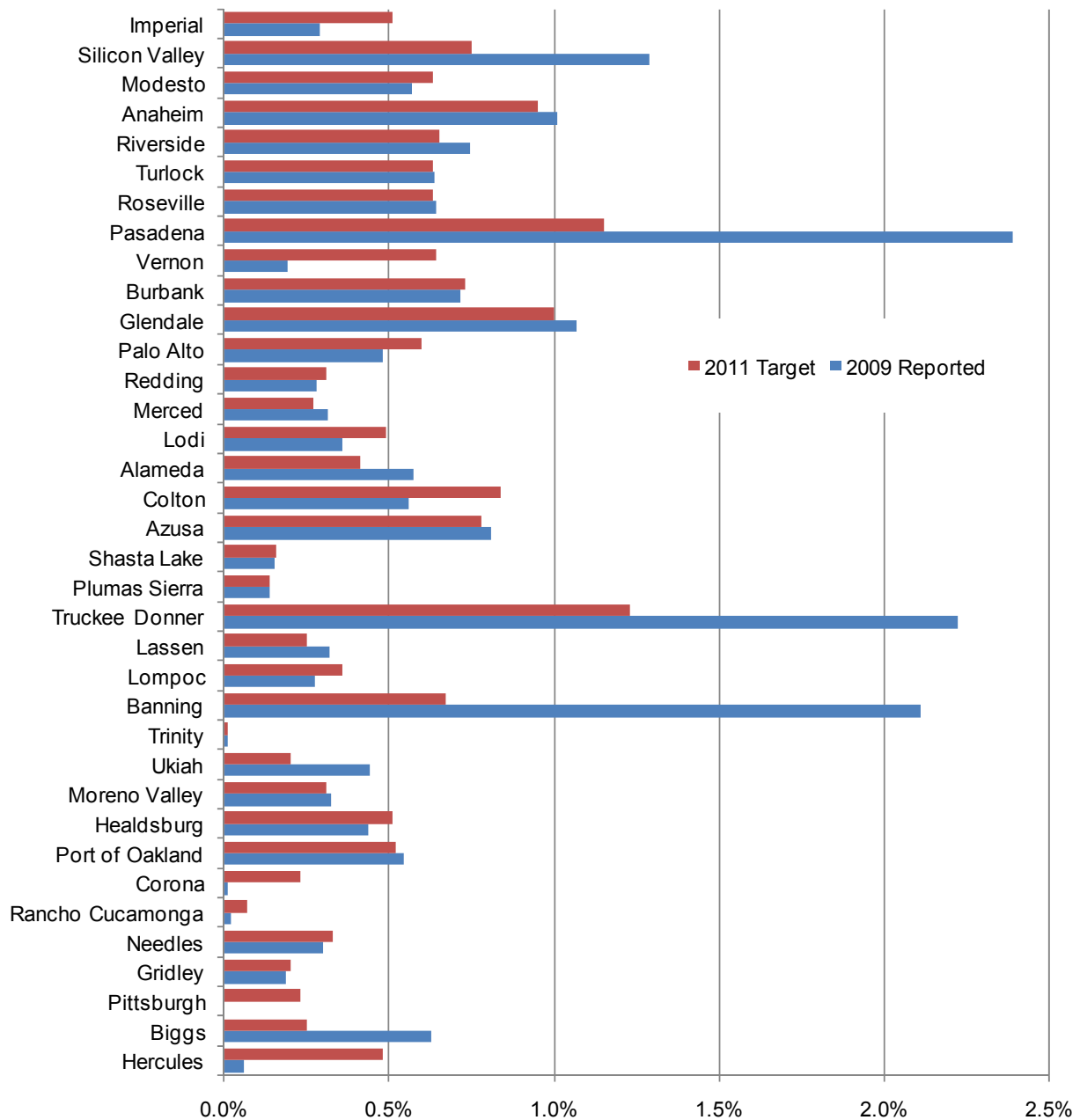
**Figure 13: Comparison of 2011 Targets Between  
2007 Target-Setting Process and 2010 Target-Setting Process**



Note: Utilities are ordered by system size (based on load).

Source: Data from 2010 obtained from California Municipal Utilities Association, *Energy Efficiency in California's Public Power Sector. A Status Report*, March 2010. Data from 2007 obtained from California Municipal Utilities Association, *Establishing Energy Efficiency Targets: A Public Power Response to AB2021. Final Update*, October 2007.

**Figure 14: Comparison of 2011 Target and 2009 Reported Savings, Percentage of Energy Use**



Note: Utilities are ordered by system size (based on load).

Source: Data obtained from California Municipal Utilities Association, *Energy Efficiency in California's Public Power Sector. A Status Report*, March 2010.

One factor in assessing the feasibility of targets is how quickly they ramp up. Utilities must support targets that increase rapidly with expanded efficiency programs, which require additional funding and staffing. From 2011 to 2012, most of the utilities showed an initial decrease in targets consistent with decreased market savings potential caused by lighting efficiency standards that go into effect in 2012. The standards decrease the potential from CFLs

from 2012 and beyond. Half of the utilities reach their maximum MWh targets in 2020. Most of the rest show a pattern of increasing targets, peaking between 2015 and 2018, and then declining through the end of the period. Trinity's targets are essentially flat through the entire period.

**Table 8** shows targets as a percentage of energy use from 2011 to 2018. Most utility targets peak between 2015 and 2018, then decline. Lassen PUD's targets almost triple from 2011 to 2018 and Plumas Sierra's targets quadruple through 2018. Some of the other POUs have targets that increase more than 10 percent per year for some portion of the period. While aggressive, these rates of expansion should be possible with additional staffing. Plumas Sierra and Lassen, however, have extremely aggressive growth rates over long periods, which may be more difficult to sustain.

**Table 9** shows demand reduction targets as a percentage of energy use from 2011 to 2018. The market savings potentials estimated by the POUs are the basis of the demand reduction targets. The collective demand reduction targets also mostly peak between 2015 and 2018 and then decline slightly.

**Table 8: Energy Reduction Targets as a Percentage of Energy Use, 2011 to 2018**

	<b>2011</b>	<b>2012</b>	<b>2013</b>	<b>2014</b>	<b>2015</b>	<b>2016</b>	<b>2017</b>	<b>2018</b>
<b>Hercules</b>	0.48%	0.44%	0.49%	0.54%	0.55%	0.56%	0.55%	0.54%
<b>Biggs</b>	0.25%	0.19%	0.19%	0.21%	0.23%	0.25%	0.23%	0.21%
<b>Pittsburg</b>	0.23%	0.21%	0.22%	0.26%	0.30%	0.35%	0.35%	0.34%
<b>Gridley</b>	0.20%	0.19%	0.19%	0.21%	0.24%	0.25%	0.26%	0.26%
<b>Needles</b>	0.33%	0.25%	0.27%	0.30%	0.33%	0.36%	0.37%	0.37%
<b>Rancho Cucamonga</b>	0.07%	0.08%	0.09%	0.10%	0.11%	0.13%	0.14%	0.15%
<b>Corona</b>	0.23%	0.23%	0.26%	0.30%	0.33%	0.37%	0.39%	0.42%
<b>Port of Oakland</b>	0.52%	0.53%	0.51%	0.48%	0.48%	0.53%	0.56%	0.56%
<b>Healdsburg</b>	0.51%	0.45%	0.40%	0.49%	0.52%	0.56%	0.57%	0.57%
<b>Moreno</b>	0.31%	0.25%	0.26%	0.29%	0.33%	0.34%	0.33%	0.31%
<b>Ukiah</b>	0.20%	0.20%	0.25%	0.28%	0.31%	0.34%	0.37%	0.41%
<b>Trinity</b>	0.01%	0.01%	0.02%	0.01%	0.01%	0.01%	0.01%	0.01%
<b>Banning</b>	0.67%	0.49%	0.53%	0.60%	0.62%	0.63%	0.62%	0.60%
<b>Lompoc</b>	0.36%	0.23%	0.27%	0.31%	0.37%	0.43%	0.48%	0.51%
<b>Lassen</b>	0.25%	0.25%	0.24%	0.32%	0.41%	0.54%	0.65%	0.73%
<b>Truckee</b>	1.23%	1.00%	1.02%	1.01%	1.01%	1.14%	1.25%	1.25%
<b>Plumas Sierra</b>	0.14%	0.13%	0.14%	0.15%	0.18%	0.26%	0.40%	0.61%
<b>Shasta Lake</b>	0.16%	0.15%	0.14%	0.30%	0.33%	0.36%	0.37%	0.37%
<b>Azusa</b>	0.78%	0.71%	0.77%	0.87%	0.95%	0.99%	0.99%	0.97%
<b>Colton</b>	0.84%	0.76%	0.91%	1.17%	1.27%	1.25%	1.18%	1.10%
<b>Alameda</b>	0.41%	0.43%	0.45%	0.46%	0.47%	0.48%	0.48%	0.49%
<b>Lodi</b>	0.49%	0.35%	0.39%	0.46%	0.52%	0.58%	0.59%	0.59%
<b>Merced</b>	0.27%	0.22%	0.25%	0.29%	0.33%	0.38%	0.38%	0.38%
<b>Redding</b>	0.31%	0.29%	0.34%	0.39%	0.44%	0.45%	0.43%	0.40%
<b>Palo Alto</b>	0.60%	0.65%	0.70%	0.75%	0.80%	0.80%	0.80%	0.80%
<b>Glendale</b>	1.00%	1.00%	1.00%	1.00%	1.00%	1.00%	1.00%	1.00%
<b>Burbank</b>	0.73%	0.62%	0.67%	0.77%	0.84%	0.88%	0.85%	0.82%
<b>Vernon</b>	0.64%	0.61%	0.61%	0.66%	0.74%	0.80%	0.70%	0.59%
<b>Pasadena</b>	1.15%	1.13%	1.12%	1.33%	1.31%	1.29%	1.27%	1.25%
<b>Roseville</b>	0.63%	0.61%	0.61%	0.60%	0.61%	0.66%	0.70%	0.65%
<b>Turlock</b>	0.63%	0.60%	0.64%	0.72%	0.79%	0.84%	0.82%	0.79%
<b>Riverside</b>	0.65%	0.59%	0.64%	0.73%	0.80%	0.84%	0.84%	0.82%
<b>Anaheim</b>	0.95%	0.87%	0.99%	1.21%	1.40%	1.34%	1.25%	1.16%
<b>Modesto</b>	0.63%	0.58%	0.61%	0.67%	0.74%	0.78%	0.74%	0.69%
<b>Silicon Valley Power</b>	0.75%	0.81%	0.83%	0.89%	0.91%	0.86%	0.76%	0.68%
<b>Imperial</b>	0.51%	0.42%	0.46%	0.52%	0.58%	0.63%	0.64%	0.64%

Source: Data obtained from California Municipal Utilities Association, *Energy Efficiency in California's Public Power Sector. A Status Report*, March 2010.

**Table 9: Demand Reduction Targets as a Percentage of Base Demand, 2011 to 2018**

	<b>2011</b>	<b>2012</b>	<b>2013</b>	<b>2014</b>	<b>2015</b>	<b>2016</b>	<b>2017</b>	<b>2018</b>
<b>Hercules</b>	0.46%	0.42%	0.44%	0.49%	0.51%	0.52%	0.52%	0.50%
<b>Biggs</b>	0.28%	0.23%	0.25%	0.27%	0.32%	0.38%	0.40%	0.38%
<b>Pittsburg</b>	0.17%	0.15%	0.17%	0.19%	0.22%	0.26%	0.27%	0.27%
<b>Gridley</b>	0.18%	0.18%	0.20%	0.23%	0.26%	0.30%	0.32%	0.33%
<b>Needles</b>	0.28%	0.24%	0.25%	0.28%	0.31%	0.35%	0.37%	0.37%
<b>Rancho Cucamonga</b>	0.07%	0.08%	0.09%	0.10%	0.12%	0.13%	0.14%	0.16%
<b>Corona</b>	0.30%	0.30%	0.33%	0.39%	0.44%	0.49%	0.53%	0.56%
<b>Port of Oakland</b>	0.16%	0.16%	0.18%	0.19%	0.23%	0.28%	0.27%	0.26%
<b>Healdsburg</b>	0.50%	0.49%	0.50%	0.56%	0.61%	0.67%	0.70%	0.72%
<b>Moreno</b>	0.34%	0.29%	0.31%	0.34%	0.39%	0.44%	0.44%	0.41%
<b>Ukiah</b>	0.40%	0.39%	0.42%	0.48%	0.55%	0.63%	0.68%	0.71%
<b>Trinity</b>	0.01%	0.01%	0.01%	0.01%	0.01%	0.02%	0.03%	0.03%
<b>Banning</b>	0.55%	0.45%	0.48%	0.55%	0.60%	0.66%	0.69%	0.69%
<b>Lompoc</b>	0.36%	0.24%	0.28%	0.33%	0.40%	0.47%	0.53%	0.57%
<b>Lassen</b>	0.62%	0.44%	0.48%	0.53%	0.59%	0.64%	0.67%	0.69%
<b>Truckee</b>	0.55%	0.46%	0.52%	0.62%	0.72%	0.81%	0.85%	0.86%
<b>Plumas Sierra</b>	0.09%	0.07%	0.07%	0.08%	0.09%	0.12%	0.17%	0.23%
<b>Shasta Lake</b>	0.32%	0.32%	0.38%	0.43%	0.49%	0.54%	0.57%	0.59%
<b>Azusa</b>	0.71%	0.67%	0.72%	0.81%	0.88%	0.93%	0.94%	0.93%
<b>Colton</b>	0.82%	0.80%	0.93%	1.21%	1.43%	1.41%	1.32%	1.22%
<b>Alameda</b>	0.51%	0.41%	0.42%	0.44%	0.45%	0.42%	0.38%	0.34%
<b>Lodi</b>	0.37%	0.30%	0.33%	0.38%	0.44%	0.50%	0.53%	0.55%
<b>Merced</b>	0.25%	0.22%	0.24%	0.27%	0.31%	0.35%	0.37%	0.36%
<b>Redding</b>	0.63%	0.65%	0.68%	0.68%	0.70%	0.71%	0.73%	0.75%
<b>Palo Alto</b>	0.71%	0.82%	0.90%	1.03%	1.14%	1.20%	1.14%	1.11%
<b>Glendale</b>	0.65%	0.57%	0.66%	0.86%	0.94%	0.93%	0.85%	0.77%
<b>Burbank</b>	0.58%	0.51%	0.56%	0.63%	0.69%	0.73%	0.72%	0.70%
<b>Vernon</b>	0.48%	0.46%	0.46%	0.50%	0.56%	0.60%	0.54%	0.46%
<b>Pasadena</b>	1.01%	0.94%	1.00%	1.12%	1.23%	1.30%	1.31%	1.27%
<b>Roseville</b>	0.53%	0.52%	0.51%	0.51%	0.52%	0.57%	0.62%	0.60%
<b>Turlock</b>	0.55%	0.46%	0.52%	0.62%	0.72%	0.81%	0.85%	0.86%
<b>Riverside</b>	0.58%	0.55%	0.59%	0.67%	0.75%	0.82%	0.84%	0.82%
<b>Anaheim</b>	0.88%	0.83%	0.94%	1.15%	1.36%	1.35%	1.27%	1.18%
<b>Modesto</b>	0.47%	0.44%	0.47%	0.51%	0.56%	0.60%	0.59%	0.56%
<b>Silicon Valley Power</b>	1.09%	1.20%	1.23%	1.32%	1.36%	1.31%	1.20%	1.11%
<b>Imperial</b>	0.48%	0.43%	0.46%	0.52%	0.58%	0.65%	0.77%	0.79%

Source: Data obtained from California Municipal Utilities Association, *Energy Efficiency in California's Public Power Sector. A Status Report*, March 2010.

## A Brief Comparison of LADWP and SMUD

SMUD submitted revised savings targets to the Energy Commission in 2010. LADWP is updating its targets but at this writing had not yet done so. Its 2007 targets therefore remain in effect. **Table 10** summarizes both the targets of these two large utilities and the CMUA group as a whole. The CMUA targets are also broken into subgroups by utility size, as defined in **Figure 9**. **Figure 15** shows shares of base use and cumulative targets by utility group and size, focusing on 2011 to 2016 so that it can compare LADWP on an equal basis. As expected, the contribution to targets of small- and mid-sized utilities in the CMUA group is less than their contribution to overall energy use. The contribution to targets of the larger utilities in the CMUA group is also lower than their share of overall energy use, while SMUD's is higher.

**Table 10: Summary of Reported Savings and Annual Targets by Utility Group and Size—MWh**

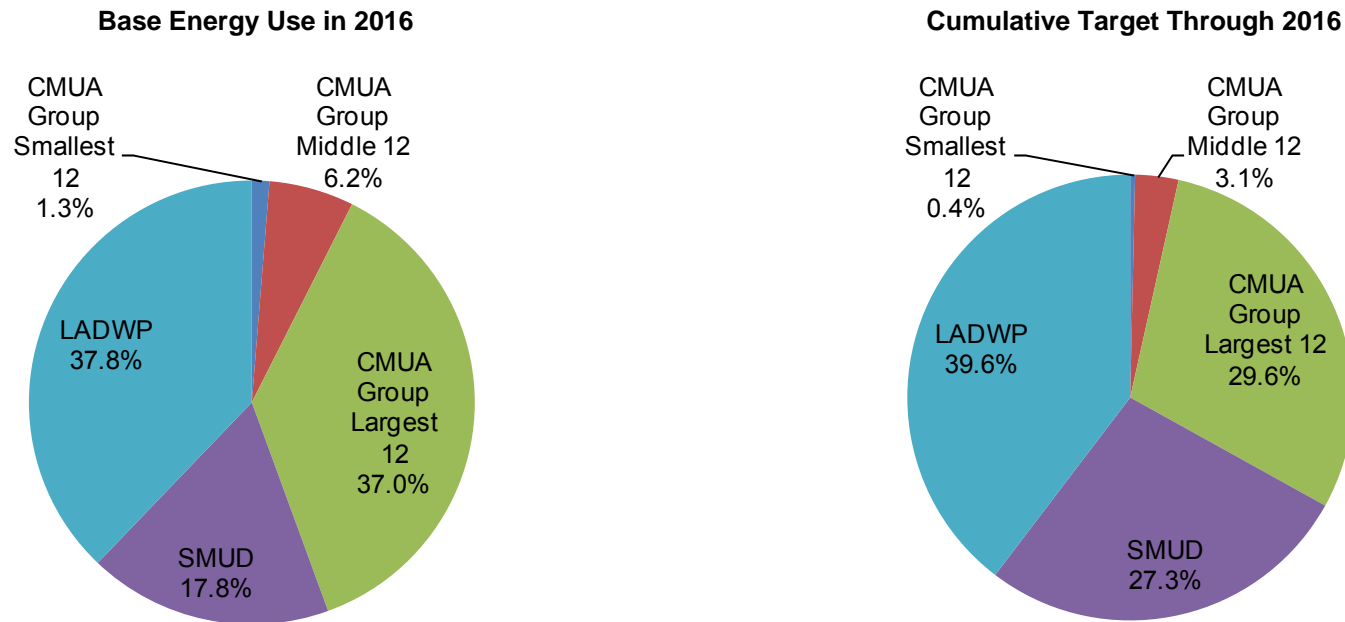
	<b>2009 Reported</b>	<b>2011</b>	<b>2012</b>	<b>2013</b>	<b>2014</b>	<b>2015</b>	<b>2016</b>	<b>2017</b>	<b>2018</b>	<b>2019</b>	<b>2020</b>
<b>LADWP*</b>	287,574	255,000	252,000	252,000	252,000	252,000	252,000	NA	NA	NA	NA
<b>SMUD</b>	148,028	166,000	169,000	171,000	175,000	179,000	183,000	185,000	187,000	190,000	194,000
<b>CMUA Group**</b>	208,209	186,048	178,090	191,537	218,269	239,807	249,461	245,306	238,218	231,724	226,448
<b>CMUA Group Largest 12</b>	186,633	166,723	160,825	172,079	195,065	213,822	221,456	216,308	208,730	202,142	196,740
<b>CMUA Group Middle 12</b>	19,967	17,308	15,348	17,394	20,868	23,430	25,192	26,050	26,453	26,460	26,491
<b>CMUA Group Smallest 12</b>	1,609	2,017	1,917	2,064	2,336	2,555	2,813	2,948	3,035	3,122	3,217
<b>Total – All POUs</b>	643,811	607,048	599,090	614,537	645,269	670,807	684,461	682,306*	677,218*	673,724*	672,448*

\*Because LADWP's targets set in 2007 extend only through 2016, the total from 2017 to 2020 assumes LADWP's target of 252,000 MWh for 2016 to be extended through 2020.

\*\*Refers to the 36 publicly owned utilities who reported energy efficiency savings, energy savings potentials and targets in the California Municipal Utilities Association (CMUA) March 2010 report.

Source: Data for LADWP obtained from California Municipal Utilities Association, *Establishing Energy Efficiency Targets: A Public Power Response to AB2021. Final Update*. October 2007. Data for SMUD obtained from informal PowerPoint presentation titled "SMUD's AB 2021 2011-2020 Goals.pptx" dated May 4, 2010. Data for CMUA Group obtained from California Municipal Utilities Association, *Energy Efficiency in California's Public Power Sector. A Status Report*, March 2010. Data for 2009 reported savings obtained from California Municipal Utilities Association, *Energy Efficiency in California's Public Power Sector. A Status Report*, March 2009.

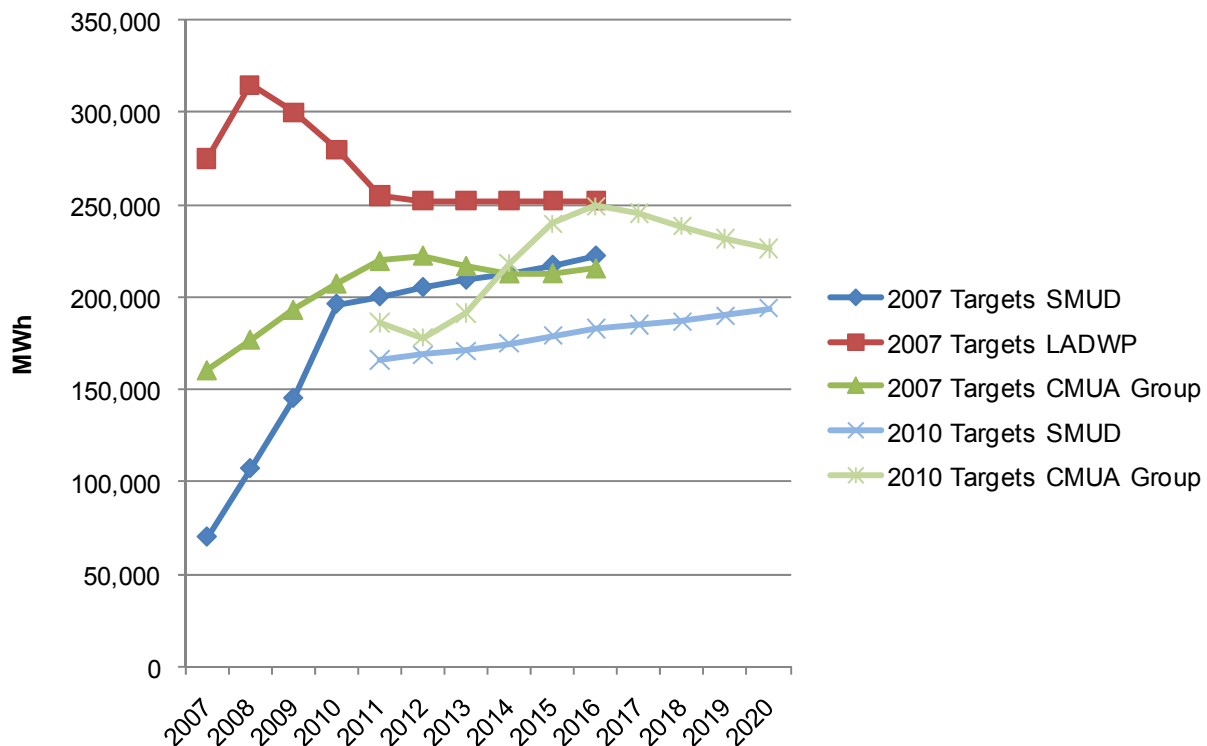
**Figure 15: Shares of Base Energy Use and Targets by Utility Group and Size**



Source: Data for LADWP obtained from California Municipal Utilities Association, *Establishing Energy Efficiency Targets: A Public Power Response to AB2021. Final Update*. October 2007. Data for SMUD obtained from informal PowerPoint presentation titled "SMUD's AB 2021 2011-2020 Goals.pptx" dated May 4, 2010. Data for CMUA Group obtained from California Municipal Utilities Association, *Energy Efficiency in California's Public Power Sector. A Status Report*, March 2010.

**Figure 16** compares the 2007 targets to the 2010 targets over time, by utility group. Both SMUD and the CMUA group lowered their targets for 2011 through 2013 with their 2010 target revisions. This may be due, in part, to the effect of codes and standards revisions (especially for lighting) and the effect of the recession that adversely affected business and personal spending, including investment in energy efficiency. SMUD's updated targets are now lower for each year through 2020 compared to its previous targets adopted for 2007 through 2016.

**Figure 16: Comparison of 2007 Targets to 2010 Targets**



Note: LADWP has not set revised targets, so the 2007 targets remain in place.

Source: Data from 2007 obtained from California Municipal Utilities Association, *Establishing Energy Efficiency Targets: A Public Power Response to AB2021. Final Update*. October 2007. Data for 2010 SMUD obtained from informal PowerPoint presentation titled "SMUD's AB 2021 2011-2020 Goals.pptx" dated May 4, 2010. Data for 2010 CMUA Group obtained from California Municipal Utilities Association, *Energy Efficiency in California's Public Power Sector. A Status Report*, March 2010.

Half of the utilities in the CMUA group set their 2011 targets lower than their 2009 reported savings. Collectively, 2011 targets added up to only 89 percent of 2009 reported savings (186,000 MWh target, as compared with 209,000 MWh reported savings).

SMUD's revised targets show a similar ramp-up from 2011 to 2016, similar to its 2007 targets (just starting from a lower level). The CMUA group's 2007 targets flattened after 2011; its revised targets show a marked ramp-up from 2012 to 2016, which is even steeper than its ramp-up in the 2007 targets from 2007 to 2011.

## CHAPTER 4: Assessing 12 of the Larger Utilities

This chapter describes the assessment of the CalEERAM models submitted by some of the larger POU's. These POU's used the models to develop revised energy efficiency targets for the 2011 – 2020 period. The chapter focuses on the structure, assumptions, and data inputs of the model(s) and compares key model outputs. Outputs include both technical and economic savings potential and market savings potential. The chapter also discusses the source of the adopted targets (not all targets came from the achievable potentials developed from the potential models) and compares targets across utilities, in more detail.

### General Model Structure and Capabilities (Framework 1)

Comprehensive potential studies generally build up savings from assumptions about measure costs and savings, building stocks, nonmarket barriers, consumer preferences, codes and standards, and energy prices. (These are often referred to as *bottom-up studies*.) Studies with smaller budgets may alternatively develop baseline usage (by sector and building type, for example) and apply potential savings estimates from another, more comprehensive study from another utility or region (often referred to as *top-down studies*). The CalEERAM model is a bottom-up model but relies heavily upon measure data from other studies, particularly Itron's 2008 potential study for California's investor-owned utilities (IOUs) and the E3 Reporting Tool.<sup>18</sup>

Potential studies may calculate a number of different types of energy efficiency potential: technical, economic, maximum achievable, program achievable (budget constrained), and naturally occurring. These potentials are described below.

- *Technical savings potential* refers to the complete penetration of all measures analyzed in applications where they are deemed technically feasible from an engineering perspective. It is not usually associated with a period and is calculated as if all possible measures were installed instantaneously.
- *Economic savings potential* refers to the technical savings potential of only the energy efficiency measures that are cost-effective when compared with supply-side alternatives (based on a selected cost-effectiveness metric). Like technical savings potential, it is usually instantaneous and not associated with a specific period.
- *Maximum achievable potential* is the amount of savings achievable through energy efficiency programs, assuming the most adept program design and execution achieved by similar programs. Unlike technical and economic savings potential, it is associated with a specific period. It is therefore limited by the rate at which replace-on-burnout measures turn over

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<sup>18</sup> Itron, 2008. *California Energy Efficiency Potential Study*. Available from [www.calmac.org](http://www.calmac.org).

(equipment failure), and the rate at which new buildings are constructed, as well as market barriers and patterns of technology adoption. The maximum achievable potential scenario takes into account that other avenues, such as building codes and appliance standards may aide in achieving some technical and economical potential.

- *Market savings potential* refers to savings from specific program funding and measure incentive levels over a specific period. Savings associated with market savings potential are savings projected beyond those that would normally occur without market intervention and can vary by level of program effort.
- *Naturally occurring potential* refers to estimated savings from normal market forces without either utility or government intervention.

The CalEERAM model calculates technical, economic, and market savings potential, as well as naturally occurring savings. The model equates maximum achievable potential with economic savings potential.

The model uses the TRC test to determine whether measures are cost-effective and should be included in the economic savings potential calculation. This test compares the present value of costs for both participants and program administrators with the present value of benefits, including avoided energy supply and demand costs. In addition to the TRC test, the model calculates other cost-effectiveness metrics: the utility cost test, the participant cost test, and the ratepayer impact test. Each test has a different boundary for the types of costs and benefits included when evaluating its measures. The ratepayer impact test evaluates the effect of changes in utility revenues and costs on customer rates. The utility (or program administrator) cost test looks only at the effects of the efficiency initiative on the utility (ignoring costs and benefits to participants), while the participant cost test does the opposite by looking only at participant costs and benefits while ignoring costs and benefits to the utility.<sup>19</sup>

KEMA found the logic of the model's calculations reasonable, with measure-level savings applied to the appropriate building stock to calculate technical, economic, and market savings potentials. Summit Blue (now Navigant) designed the model to accommodate a wide range of measures. The design of the model allows users to change key inputs and so it can be customized for each utility.

The model allows only limited changes to model inputs over time. It allows rates and avoided costs to change over time, but measure inputs, with limited exceptions, are not. To model codes and standards, the model allows a one-time change to measure savings in a specific year. For example, the modelers model the upcoming implementation of new efficiency standards for screw-based lamps as a one-time reduction in savings for compact fluorescent lamps in 2012. The model accommodates an initial savings level, a revised level, and the effective date of the revised level.

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<sup>19</sup> *California Standard Practice Manual: Economic Analysis of Demand-Side Programs and Projects*, California Public Utilities Commission, San Francisco, October 2001.

In any estimate of efficiency potential associated with a particular period, it is necessary to track both the rate of building decay (the rate at which buildings are torn down, abandoned, or undergo a complete gut remodel) and the rate of new construction. The interaction of these two factors must result in a building forecast (in number of buildings, floor space, or in some cases, base energy use, depending on the sector being analyzed) that is consistent with the utility's load forecast. The CalEERAM model links an overall housing stock forecast to the growth rate in the load forecast. The utilities decrease the existing single and multifamily forecasts over time using an assumed decay rate. The model then calculates new construction to calibrate to the overall housing stock. It calculates nonresidential floor space similarly.

The remaining topics in Framework 1 overlap significantly with Framework 2. The following section discusses these issues.

## **CalEERAM Model Evaluation Results—POU-Specific Models (Framework 2)**

The following sections discuss the results of applying the second evaluation framework to the 12 available completed CalEERAM models. Examining the models in detail allowed reviewers to assess the effects of differing assumptions on the results of the models. The 12 models belonged to Anaheim, Burbank, Glendale, Imperial, Modesto, Palo Alto, Pasadena, Riverside, Roseville, Silicon Valley Power, Truckee, and Turlock.

### **Reporting and Documentation Adequacy**

The modelers documented most of the general inputs (such as the rate of inflation, discount rates, electricity rates, and energy use) within the model. The CMUA 2010 report provides sources for most of the remaining inputs, notably the 2010 E3 Reporting Tool<sup>20</sup> and the 2008 California Energy Efficiency Potential Study conducted by Itron.<sup>21</sup> The latter two sources provide most of the measure data required for the analysis.

### **Customer Disaggregation**

The CalEERAM model is set up to model three residential building types (residential new construction, single-family existing buildings, and multifamily existing buildings), four commercial building types (three specified by the utility plus a miscellaneous category<sup>22</sup>), and one industry (specified by the utility). Based on the model documentation, each POU chose the segments to represent the largest contributors to sales volume in each sector. **Table 11** shows

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20 For information on E3's calculators and tools, see [http://ethree.com/public\\_projects/cpuc4.html](http://ethree.com/public_projects/cpuc4.html).

21 Itron, 2008. *California Energy Efficiency Potential Study*. Available from [www.calmac.org](http://www.calmac.org).

22 CalEERAM nonresidential miscellaneous category is modeled as a commercial building type with the same measures as other commercial buildings. However, it captures all the nonresidential floor space not captured elsewhere, both commercial and industrial.

which customer segments each utility included in its model. While Truckee’s model was set up to analyze food processing, the utility did not calculate industrial savings since the model omitted floor space inputs.<sup>23</sup>

**Table 11: Included Customer Segments by Utility, as Organized in CalEERAM**

	Residential			Commercial							Industrial				
	Res New Constructio	SF Existing	MF Existing	Office	Retail	Restaurant	Health	Food Store	School	Lodging	Miscellaneous	NAICS 311* Food	NAICS 325* Chemicals	NAICS 334* Electronics	NAICS 513*
Anaheim	X	X	X	X	X					X	X			X	
Burbank	X	X	X	X	X		X				X				X
Glendale	X	X	X	X	X		X				X	X			
Imperial	X	X	X	X	X				X		X	X			
Modesto	X	X	X	X	X	X					X	X			
Palo Alto	X	X	X	X			X	X			X			X	
Pasadena	X	X	X	X			X		X		X				X
Riverside	X	X	X	X	X				X		X		X		
Roseville	X	X	X	X	X		X				X			X	
SVP	X	X	X	X	X				X		X			X	
Truckee	X	X	X	X	X	X					X				
Turlock	X	X	X	X	X		X		X		X	X			

\*NAICS stands for North American Industry Classification System, a widely used system for categorizing industries.

Source: Data obtained from California Energy Efficiency Resource Assessment Models (October 2010). Data for Truckee obtained from California Energy Efficiency Resource Assessment Models (July 2010).

While KEMA’s reviewers recognize the value of concentrating data collection efforts on the building segments with the highest energy use, having different segments for each utility makes it difficult to compare results across those utilities. The top four commercial building types might represent 40 percent of commercial energy use at one utility and 60 percent in another. In addition, the segment identified as miscellaneous commercial is, in fact, a catch-all category for all energy use not captured elsewhere, including any industries or commercial building types not explicitly categorized. As a result, this segment is not strictly comparable across utilities. For example, Anaheim’s “miscellaneous” includes restaurants but not lodging; Modesto’s includes lodging but not restaurants. Also, as the authors will discussed in greater detail below, E3 Reporting Tool’s commercial miscellaneous segment, which is a poor match with how the segment is defined in this study provides the data inputs used for the miscellaneous segment. KEMA believes that expanding the commercial segments to a consistent list across utilities would produce results that are both more robust and more comparable. It would also bring the

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<sup>23</sup> Truckee’s customer base is almost entirely residential and commercial.

definition of miscellaneous more in line with other similar studies and with the data sources used for the study.

### Measure List

The lists of specific measures included in the models were very similar. **Table 12** shows the measures included, by sector, for the majority of POUs. The report discusses exceptions to the standard list below.

**Table 12: Standard Measure List for the CalEERAM Model**

**Residential New Construction**

- CFL: Screw-In (<=15W), direct install
- CFL: Screw-In (16-24W), direct install
- CFL: Screw-In (>=25W), direct install
- CFL: Torchiere, Average Wattage
- LED Holiday Lights (100 bulb string)
- Energy Star Refrigerator
- Clothes Washer
- Dishwasher- Average
- Hot Water Heater, electric high efficiency heater, residential
- Solar Hot Water Heater, replacing electric water heater
- 19-21 SEER Split System, Average
- Ground-Source Heat Pump, AC Saving Only

**Residential Existing Construction**

- CFL: Screw-In (<=15W), direct install
- CFL: Screw-In (16-24W), direct install
- CFL: Screw-In (>=25W), direct install
- CFL: Torchiere, Average Wattage
- LED Holiday Lights (100 bulb string)
- LED Exit Sign
- Occupancy Sensors
- Photocells
- Energy Star Refrigerator
- Refrigerator Recycling - removal of secondary refrigerator - unconditioned space
- Freezer Recycling - removal of secondary freezer - unconditioned space
- Clothes Washer
- Dishwasher- Average
- VSD Pool Pumps
- Hot Water Heater, electric high efficiency heater, residential
- Solar Hot Water Heater, replacing electric water heater
- Hot Water Heater Tank Wraps
- Ceiling Insulation, existing plus new insulation equal to R-38
- Wall Insulation, R-13, blown-in (baseline condition: no insulation)
- Radiant Barriers
- Window Film: Single Pane Clear Glass with Standard Film
- Refrigerant Charge
- Duct Sealing
- CEE Tier 3 - Split AC 16 SEER (13 EER) (single-family only)
- 19-21 SEER Split System, Average (multifamily only)
- Ground-Source Heat Pump, AC Savings Only
- 18 SEER (12.8 EER) / 9.2 HSPF (3.66 COP) - Electric Heat Pump
- Room Air Conditioner
- Whole House Fan with Air Conditioning
- Shade Trees (single-family only)

**Commercial**

- Standard T12 to T8 Lamps with Electronic Ballasts - 4 foot
- Standard T12 to T8 Lamps with Electronic Ballasts - 8 foot
- Delamp: 4 foot lamp
- Delamp: 8 foot lamp
- Metal Halide - 100W or less, (pulse start or ceramic) retrofit of std MH fixture
- Metal Halide - 101 - 200W, (pulse start or ceramic) retrofit of std MH fixture
- Metal Halide - 201 - 350W, (pulse start or ceramic) retrofit of std MH fixture
- High Efficiency Exit Signs (LED, CFL, T5)
- Occupancy Sensor
- Photocell
- Time clock
- Dimmable Electronic Ballasts
- Electric Resistance Water Heater, High-Efficiency, Non-Residential
- Packaged terminal air-conditioner (< 7kbtuh)
- Package system A/C (< 5.4 tons, 14 SEER)
- Package system A/C (>=63.3 tons, 10.2 EER)
- <150 tons Centrifugal Water Cooled Chiller
- Reciprocating Chillers, Water-Cooled
- Refrigerant Charge
- Plug Load Occupancy Sensor
- Vending Machine Controller - Uncooled Snack Machine
- Vending Machine Controller - Cold Drink
- Anti-Sweat Heat (ASH) Controls (or Humidistat Controls)
- Large Vat Fryer
- Convection Oven
- Griddle
- Steamer Cooker
- Insulated Hot Food Holding Cabinet: Half Size <=0.3 kW
- Strip-Curtains for Walk-in Enclosures
- EC Motor: Reach-In Enclosure
- EC Motor: Walk-In Enclosure

**Industrial**

- Compressed Air
- Heating
- Lighting
- Fans
- Cooling
- Other
- Refrigeration
- Drives
- Pumps

Source: Data obtained from California Energy Efficiency Resource Assessment Model (October 2010) completed by Anaheim Public Utilities.

A few utilities slightly altered the measure list. The typical residential high-efficiency air conditioner measure modeled for most utilities was a seasonal energy efficiency ratio (SEER) 16 unit for single-family existing and a SEER 19 to 21 unit for multifamily and new construction. Roseville, however, substituted a SEER 15 unit for all three residential building types, while Truckee went in the opposite direction with a SEER 19 to 21 unit for single family. Truckee, which has a winter peak and a significant electric heating share, also included both heating and cooling savings for heat pumps while the rest of the utilities considered only cooling savings. Truckee is the only utility among the 12 with a winter peak.

The utilities nominally included some measures (such as the SEER 18 heat pump measure) in the measure list, but these measures were missing key input data such as savings and costs. Therefore, the model did not evaluate such measures for cost-effectiveness and did not contribute to the savings potentials of any of the utilities.

KEMA's investigation into the model revealed that while the calculation of technical savings potential uses the entire measure list, the model allowed the utilities to explicitly include or exclude measures from consideration in the economic and market savings potential—regardless of the results of the TRC test. **Table 13** shows the explicit exclusions, listed by utility. Roseville and Truckee have significant exclusions compared with the other utilities. Exclusions for the other utilities are limited to one or two measures for a single building type (for example, miscellaneous buildings).

**Table 13: Measures Explicitly Excluded From Economic and Market Potential, by Utility**

	<b>Residential</b>	<b>Commercial</b>	<b>Industrial</b>
Anaheim	None	CFL-Screw-In (14-26W) (misc. buildings) Package system A/C ( $\geq 63.3$ tons, 10.2 EER) (misc. buildings)	None
Burbank	None	None	None
Glendale	None	None	None
Imperial	None	None	None
Modesto	None	None	None
Palo Alto	None	None	None
Pasadena	None	Package system A/C ( $\geq 63.3$ tons, 10.2 EER) (misc. buildings)	None
Riverside	None	None	None
Roseville	CFLs LED holiday lights LED exit sign Occupancy sensors Photocells Hot water heater tank wrap	Hardwired CFLs Hardwired fluorescent fixtures Metal halide fixture Time clock Electric resistance water heater Chillers Refrigerant charge Vending machine controller (uncooled vending machines) Griddle Steamer Hot food holding cabinet	Heating
SVP	None	None	None
Truckee	Pool pumps Radiant barriers Refrigerant charge Shade trees	Packaged terminal air-conditioner ( $< 7$ kbtuh) Package system A/C ( $< 5.4$ tons, 14 SEER) Chillers Refrigerant charge Anti-sweat heat controls	Compressed air
Turlock	None	Package system A/C ( $\geq 63.3$ tons, 10.2 EER) (misc. buildings)	None

Source: Data obtained from California Energy Efficiency Resource Assessment Models (October 2010). Data for Truckee obtained from California Energy Efficiency Resource Assessment Models (July 2010).

The measure “Package system A/C ( $\geq 63.3$  tons, 10.2 EER)” appeared on the excluded list for three utilities and was explicitly included by two other utilities, in each case for only one or two building types. This measure had a TRC close to one and was greater than one in some building types in many climate zones. The explicit inclusions and exclusions resulted in the measure’s inclusion or exclusion for all building types, suggesting that program design considerations influenced these decisions. Many of the Roseville and Truckee exclusions, however, applied to all building types.

From a modeling perspective, explicit exclusions and inclusions are appropriate when calculating the potential associated with a specific program design, which in this model is

represented by the market savings potential calculations. A utility may wish to exclude a particular measure from its programs if, for example, it anticipates that high rates of free ridership would negatively affect the cost-effectiveness of the program. Issues of fairness or equity may come into play if the utility cannot appear to discriminate between different groups of customers (for example, hotels versus offices), even when a measure is cost-effective for one group but not the other (as with the package system A/C). Considerations such as these should not limit economic savings potential, however, since it is, by definition, a theoretical limit: the savings that could be achieved if all cost-effective measures were implemented. By applying the exclude/include filter to the economic savings potential calculation, the CalEERAM model produces something that is not a true economic savings potential for the utilities that used those filters.

The other side of explicit exclusions is explicit inclusions, shown in **Table 14**. As discussed above, Package system A/C ( $\geq 63.3$  tons, 10.2 EER) may have been flagged for inclusion for consistency with other building types.

**Table 14: Measures Explicitly Included in Economic and Market Potential, by Utility**

	<b>Residential</b>	<b>Commercial</b>	<b>Industrial</b>
Anaheim	None	None	None
Burbank	None	None	None
Glendale	None	None	None
Imperial	None	None	None
Modesto	None	Package system A/C ( $\geq 63.3$ tons, 10.2 EER) (misc. buildings)	None
Palo Alto	Clothes washer Dishwasher Hot water heater Ceiling insulation Wall insulation	None	None
Pasadena	None	None	None
Riverside	None	None	None
Roseville	CAC SEER 15	Package system A/C ( $\geq 63.3$ tons, 10.2 EER) (office, health) CAC SEER 16	None
Silicon Valley	None	None	None
Truckee	Ground-source heat pump (heating and cooling)	Ground-source heat pump	None
Turlock	None	None	None

Source: Data obtained from California Energy Efficiency Resource Assessment Models (October 2010). Data for Truckee obtained from California Energy Efficiency Resource Assessment Models (July 2010).

Palo Alto included appliances and insulation despite showing a TRC of less than one in the analysis. Of the utilities studied in detail, only Palo Alto provided both gas and electric service. This may have affected Palo Alto's decision to include clothes washers, dishwashers, and insulation measures in its analysis even though electricity savings did not justify the inclusion. Clothes washers and dishwashers save natural gas through water heating, while insulation saves energy for both space cooling and heating (which is predominantly natural gas in most of California).

Of all the models KEMA reviewed, only Truckee included ground-source heat pumps for both heating and cooling (Truckee has a winter peak, which may explain the focus on electric heat).

The measure list used for the CalEERAM model included a Consortium for Energy Efficiency (CEE) Tier 3, SEER 16 air conditioner. This efficiency level is quite aggressive, and the measure passed the cost-effectiveness screening only for Imperial Irrigation District. In its model, Roseville replaced the SEER 16 measure (which would have failed the TRC test in its climate zone) with a SEER 15 unit that passed the TRC test. As a result of Roseville's substitution, it is one of only two POU's with a cost-effective residential central AC measure. KEMA's reviewers believe that the other utilities, faced with a SEER 16 AC measure that failed the TRC test, should have followed Roseville's lead in evaluating lower SEER levels to see if a SEER 14 or 15 unit was cost-effective. By not doing so, these utilities may have understated their economic and market savings potentials.

## Measure Inputs

Modelers drew measure data inputs for the CalEERAM model from reliable sources. The 2010 E3 Reporting Tool provided measure savings, measure costs, load-shape data, peak impacts, net-to-gross factors, and measure life. The E3 Reporting tool, in turn, draws data from the California Database for Energy Efficiency Resources (DEER),<sup>24</sup> a resource for deemed energy savings used extensively by California utilities. The *2008 California Energy Efficiency Potential Study*, conducted by Itron<sup>25</sup>, provided data on equipment densities and saturations of efficient technologies. The *2004 California Statewide Residential Appliance Saturation Survey* (KEMA-Xenergy 2004), which was the most current saturation study available at the time, provided fuel shares.

These data sources are generally reliable and probably represent the best available data without collecting primary data in each POU's service territory. Nevertheless, the data may be criticized on a number of fronts. Because some of the data are old, they may not represent current market conditions. In addition, the data was not collected specifically for the POU service territories and thus may not represent local conditions. For example, a representative from Glendale stated

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<sup>24</sup> <http://www.energy.ca.gov/deer/>

<sup>25</sup> Itron, *2008 California Energy Efficiency Potential Study*. Available from [www.calmac.org](http://www.calmac.org).

that most Glendale homes are smaller than average, less than 1,000 square feet. In this case, kilowatt-hour (kWh) savings per home, based on the average home in California, may be too high for Glendale homes, resulting in an overestimate of savings potential. While the data used may be the best available, both the POU and the Energy Commission must be aware of the limitations and uncertainty in the data.

One key issue with the measure inputs is the treatment of miscellaneous nonresidential buildings. Miscellaneous nonresidential buildings (commercial and industrial) make up 12 to 58 percent of nonresidential energy use, depending on the utility, and 11 to 38 percent of total energy use. The miscellaneous category is a catchall for buildings not explicitly broken out by the CalEERAM model in either the commercial or the industrial segment. As discussed earlier in the report, the CalEERAM model explicitly breaks out three commercial building types and one industry for each utility. The miscellaneous segment in the model captures all the remaining energy use, meaning essentially, whatever building types and industries each utility has left over.

The commercial miscellaneous building type as defined in DEER, which is defined much more narrowly than miscellaneous in the CalEERAM model, provides the measure savings assigned to this catchall category. DEER does not include restaurants, retail, grocery, lodging, schools, health, or any industries in its miscellaneous commercial category, yet each of the POU models studied lumps more than one of those building types into miscellaneous. Because of this definitional mismatch, miscellaneous savings from the E3 reporting tool are not appropriate for miscellaneous, as defined in the CalEERAM model. Because savings potential is often low in miscellaneous buildings (as narrowly defined in DEER) when compared with other building types, the model may underestimate savings for its definition of miscellaneous by using these inputs.

### Measure Cost Inputs

The evaluation framework examined two specific issues with respect to measure cost inputs. The first was whether utilities applied full and incremental costs appropriately in the model, and the second was whether cost units align with savings units.

Whether the modeler defines a measure as a retrofit or as replace on burnout drives the choice of full or incremental costs. The modeler uses incremental costs for replace-on-burnout measures because the old unit must be replaced and the choice is then between a new standard efficiency unit and a new high-efficiency unit. The purchaser spends the cost of the standard unit regardless of the choice, so only the incremental cost of switching to high efficiency is included in the model. For retrofit measures, the old equipment has not failed, as might happen if all the existing lighting fixtures were systematically replaced with high-efficiency fixtures, or with a measure like insulation that reduces the energy use of other (heating or cooling) equipment.

The model does not directly indicate whether measures are either retrofit or replace on burnout, but costs appear to be a mix of incremental and full costs. Most of the measures that seem to be

using full costs (like duct sealing and window film) seem to be appropriate. However, analysts generally consider some measures that the model assigned full costs, such as clothes washers, dishwashers, and water heaters, to be replace-on-burnout measures and should therefore use incremental costs. Higher costs make a measure less cost-effective, so the model may incorrectly omit these measures from economic and market savings potential calculations. However, due to the low incidence of electric water heating in most of the utility service territories, the effect of these specific measures is probably small.

When calculating cost-effectiveness, savings must either align with costs in the inputs or the model must align them. In other words, if the model expresses savings as savings per household, then it must express costs expressed as cost per household. If the model inputs costs and savings on a different basis, for example, if savings are per household but costs are per unit, then it is critical that the model have some way to align the two – as, for example, the number of units per household.

The CalEERAM model specifies a unit definition, such as “tons cooling” or “100 square feet of window.” The modeler must enter both density and costs on those bases. Density specifies the number of defined “units” per household for residential or per thousand square feet for commercial. The cost and savings values entered appear to be consistent with the unit definitions for all the utilities.

### Measure Savings Inputs

Savings for many measures vary depending upon weather and climate. Heating and cooling measures are typically weather-sensitive where other measures are not. Water heating is somewhat weather-sensitive due to variations in groundwater temperature and, to a lesser extent, ambient temperature, but the differences are small and typically not modeled in potential studies.

The CalEERAM model considers the climate zone of utility when pulling data from the E3 Reporting Tool. In the July versions of the models, there was an error in the climate zone for residential new construction ground-source heat pumps in some models. (The model used Climate Zone 4 for a range of climate zones.) The review of the model found that, in the models where the errors appeared, the ground-source heat pumps were not cost-effective in any case, thereby affecting technical but not economic or market savings potentials. In the October revisions a similar error cropped up for residential single-family central air conditioners in the Burbank, Glendale, and Pasadena models. As with ground-source heat pumps, central air conditioners did not pass cost-effectiveness tests for these utilities, and it only affected technical savings potential. However, one or both of these errors affected the technical savings potentials for all the utilities studied (except for Palo Alto and Truckee). The error would have been more significant had more of the utilities considered an air-conditioning measure similar to Roseville’s SEER 15 measure.

Codes and standards, which can be implemented at both the federal and state levels, take away some of the savings that would otherwise be available for capture by an efficiency program. For

example, forthcoming lighting standards require a minimum efficacy that is 30 percent higher than standard incandescent lamps. Once the standard goes into effect (staggered from 2012 to 2014), the savings for measures that replace incandescent lamps, like compact fluorescent lamps (CFLs), will go down.

The reviewed models applied the same approach to upcoming codes and standards. Beginning in 2012, the model reduced savings for CFLs and hardwired CFL fixtures by 30 percent to account for the effect of the standard in both residential and commercial sectors.<sup>26</sup> No other standards were modeled, including T12 fluorescent lighting and metal halide fixtures, both of which are affected by upcoming standards. Omitting these upcoming standards may overstate savings for the affected measures and inflate their potential.

Potential studies typically address both energy savings and peak demand reductions since avoided energy costs vary across the different times of the day and year (time-of-use). Total hourly energy use for a specific end use similarly varies over each hour of the year. The end-use load shape represents this variation of hourly use over the year. The end-use load shape represents the fraction of annual energy use that occurs in each hour (or other period) of the year. Applying 8760-hour-per-year load shapes directly to a potential model would be extremely data-intensive. Instead, the detailed load shape data can be used to derive time-of-use and coincidence factors at a higher level of aggregation, for example, by defining periods as summer peak, summer off-peak, winter peak, winter off-peak, and so on. The utilities can use these factors to allocate energy savings to different time-of-use periods and estimate peak demand from energy use and savings.

The CalEERAM model took this approach, with four time-of-use periods (summer and non-summer, peak and off peak). The E3 Reporting Tool is the source of the time-of-use periods and the coincident peak impacts.

KEMA reviewed the measure savings inputs to see if they were consistent with baseline energy use. Some potential models input measure savings as a percentage of base energy usage, while others input savings in units of energy (such as kWh per unit). The CalEERAM model inputs savings in kWh per unit. It is particularly important that the savings inputs be consistent with baseline energy use for the measure if this approach is used. For example, if the model shows a savings of 60 kWh per refrigerator, the implied percentage savings is very different depending on whether a typical refrigerator uses 600 kWh per year (providing a 10 percent savings) or 1,000 kWh per year (providing a 6 percent savings).

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<sup>26</sup> There is a great deal of uncertainty about the market effects of the new standard, in particular whether the market will supply—and consumers purchase—higher efficiency CFLs, or whether the standard will shift a significant portion of the market to CFLs. CalEERAM modeling approach assumes the former, which produces higher potential estimates than assuming a standards-induced shift to CFLs.

There is nothing inherently wrong with entering savings as a level, if the savings are (and remain) consistent with the baseline energy use. Unfortunately, the CalEERAM model does not specify an energy use baseline at the measure level, which makes it impossible to calculate the implied percentage savings.

### Measure Life Inputs

The CalEERAM model takes its measure lifetimes from the E3 reporting tool, and all appeared to be correct. The model uses appropriate measure lifetimes for both natural replacement and early replacement measures. Natural replacement refers to replacing equipment that is failing or already burnt out. Early replacement refers to replacing or removing equipment that is still working. KEMA finds that the model appropriately differentiates between these two approaches to energy efficiency measures and applies the correct measure life.

### Measure Applicability and Implementation Inputs

One key step in estimating potential is estimating the eligible building stock. Building stock is eligible to receive a measure if the type of equipment to which the measure applies serves it, and the measure is appropriate for that building stock. For example, in an electric study, a home is eligible for a high-efficiency electric water heater or tank wrap if it has electric water heating. Commercial floor space is eligible for a measure that replaces T12s with T8s if T12s currently light the building.

The CalEERAM model determines the eligible building stock with two key inputs: fuel share and applicability. On top of these factors, the model adds on technology density, which represents the number of units of equipment per home or per 1,000 square feet of nonresidential floor space (for example 1.13 refrigerators per home or 9.01 4-foot fluorescent lighting fixtures per 1,000 square feet). The model allows some flexibility as to how the utility defines the three inputs. For example, Roseville shows a freezer recycling fuel share of 100 percent, applicability of 100 percent, but only 0.133 recyclable refrigerators per home, where it would seem to be equally consistent to have an applicability of 13.3 percent with one recyclable refrigerator per applicable home. Taking all three inputs together, KEMA found the three inputs together produced reasonable estimates of the opportunity for most measures.

As with some other inputs, there were specific measures that raised questions. There seemed to be issues with maximum density CFLs. The model has three CFL measures based on wattage bins. Based on the maximum density for these measures, high-wattage (more than 25 watts) CFLs outnumber all smaller wattage CFLs by more than a factor of two. Since installers use smaller wattage CFLs (less than 25 watts) to replace the common 60- and 75 W incandescent bulbs, the reviewers would expect to see higher maximum densities for the smaller wattage CFL measures. These types of issues affected several measures and were inconsistent in their direction (too high or too low). The overall effect on potentials is uncertain.

The model specifies a base technology density, an efficient technology density, and a total maximum density. For almost all the measures, the maximum is equal to the sum of the base density and the efficient density. For clothes washers and dishwashers, however, this is not the

case. In that case the sum of the base and efficient densities is less than the maximum for these measures. The reviewers found no explanation for this puzzling finding, and the effects on the results are unknown.

### Measure Adoption Inputs

Technical and economic savings potential assume 100 percent measure penetrations into the eligible building stock. Market (or program) potential must consider the size of the incentives offered, the market barriers and cost-effectiveness of each measure, customer awareness, and other factors when determining the actual percent market penetration. This can be done through modeling (for example, using technology adoption curves), through expert judgment, or can explicitly leverage the program experience of one or more utilities to predict program impacts.

The CalEERAM model uses an adoption curve approach, based on customer payback, as the metric for customer cost-effectiveness: the lower the payback period for a given measure, the higher the adoption rate.

The model defines the adoption curve by both the payback and by two decision curve parameters that the model specifies by end use. The parameters are the same for all measures within the same end use, and the measure cannot be further differentiate them. Although the parameters for the adoption curves are the same, the different paybacks for different measures result in different market penetrations for different measures.

The model does not appear to make distinctions between the adoption rates of retrofit and replace-on-burnout measures. Replace-on-burnout measures by their nature turn over gradually, based on the typical life of the equipment. Retrofits can be done at any time and can penetrate the marketplace more rapidly as long as cost-effectiveness and awareness are high – either naturally or through program efforts. Yet penetration in the model does not depend on measure life for any of the measures, which would be required to accurately model replace-on-burnout measures. Instead, all the measures gradually increase market penetration from current levels to full penetration based on the adoption curves described above. To avoid errors (for example, adopting replace-on-burnout measures faster than the rate of equipment turnover), the modeler must take care in setting the adoption curve parameters. Checking the implementation rates, KEMA did not find that utilities implemented replace-on-burnout measures too quickly. The lack of analytical distinction between retrofit and replace-on-burnout measures, therefore, probably had little to no effect on potentials.

### Naturally Occurring Energy Savings

Some customers would adopt energy efficiency measures on their own even without energy efficiency incentive programs. This refers to as *naturally occurring energy efficiency*. These customers may take advantage of a program despite the fact that they would have invested in the energy-efficient measure without it. Although a utility could take steps to exclude such “free riders” from incentive programs, it is inevitable that some incentive payments are made for energy “savings” that would have occurred without the incentive program. In utility

program parlance, “gross savings” are the savings for all participants, including so-called “free riders.” Utilities compute net savings without free riders.

The CalEERAM model includes calculations for naturally occurring savings but does not separate free riders from naturally occurring savings from, say, a customer who buys a high-efficiency refrigerator but does not apply for a rebate. The model implicitly assumes that all naturally occurring savings are included in program savings, a common assumption in potential models. This assumption does not affect either technical or economic savings (which by definition include naturally occurring savings) or net market savings potential. It does increase gross market savings potential and program costs, thereby reducing overall program cost-effectiveness.

The model estimates naturally occurring energy savings by applying a net-to-gross factor to estimated gross potential. With the exception of shade trees, the model takes net-to-gross factors from the E3 Reporting Tool, this gives a value of 0.8 for each measure. While 0.8 has been a common ex ante assumption for California efficiency programs, recent evaluations have found lower net-to-gross values for many measures and programs. For example, evaluations of California’s IOU programs reported net-to-gross values ranging from 0.44 to 0.75 for CFLs.<sup>27</sup> Residential room air conditioners had net-to-gross ratios ranging from 0.36 to 0.40, while strip curtains for commercial refrigeration had a ratio of only 0.19. Given the model’s structure, decreasing the net-to-gross ratios to values more in line with recent evaluations would decrease net market savings potential but would not affect gross market savings potential or program costs.

The net-to-gross value for shade trees used in the model is 0.35, the model cites it as a “realization rate from San Diego EM&V results.”<sup>28</sup> While obtaining net-to-gross values from EM&V studies is desirable, realization rates are not the same as net-to-gross ratios. Using this value is therefore inappropriate. Realization rates relate ex ante savings estimates to ex post estimates and can be either net or gross – they can compare either ex ante net to ex post net or ex ante gross to ex post gross savings. They do not relate net to gross, and a low realization rate can be associated with a high net-to-gross ratio, and vice versa. KEMA is not sure if the documentation for shade trees misstates that a realization rate was used when a net-to-gross ratio was actually used, or whether a realization rate was actually misapplied as a net-to-gross ratio.

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27 KEMA, 2010. *Analysis of Publicly Owned Utility Reported and Verified Savings: Review of Energy Efficiency Program Savings Estimations in Annual Reports and Measurement and Evaluation Studies*. Prepared for the California Energy Commission, March 2010.

28 Navigant, 2010. *CalEERAM\_v9\_Anaheim*. Microsoft Excel spreadsheet. October 2010.

## Other Inputs

All the utilities studied used an inflation rate of 2.2 percent (the U.S. Bureau of Labor Statistics' average inflation for 2000 to 2009) and a utility discount rate of 4.5 percent (from the E3 Reporting Tool). The inflation rate is typical of such studies, which often use values between 2 and 3 percent. The discount rate seems somewhat low for a nominal discount rate (7 percent is more typical) but appropriate for a real discount rate. A real discount rate is appropriate only if rates and avoided costs are in constant dollars, which does not appear to be the case for the models studied (rates increase at the rate of inflation for many of the models). Lower discount rates increase the importance of future savings in cost-effectiveness calculations relative to present costs, making measures more cost-effective. For measures with a high TRC, this is not significant, but if the TRC is close to one, it could make the difference between passing and not passing. Using the lower discount rate would tend to increase economic and market savings potential, but the magnitude of the effect would depend on how many measures had TRCs close to one.

Line-loss rates were set at 3.69 percent for most utilities. Anaheim used 3.2 percent, and Palo Alto used 4.5 percent. Each model used 1 percent for all sectors, even though losses are typically lowest for industrial and highest for residential sectors. Line losses increase as voltage decreases, and residential distribution typically requires that electricity travel greater distances on lower voltage lines. The model could therefore understate savings for the residential and commercial customer sectors compared with the industrial sector.

Electricity rates affect cost-effectiveness for customers. Investment in energy-efficient technologies is a trade-off between additional purchase costs and energy bill savings that accrue over the life of the equipment. The higher the electricity rates, the greater the life-cycle energy savings and the more cost-effective the measure will be for the consumer. Higher rates therefore tend to increase both measure adoption and potentials.

In 2011, residential energy rates included in the CalEERAM models varied widely by utility, from 8.18 to 14.42 cents per kWh (c/kWh). By 2020, the range was even wider, from 9.96 to 22.06 c/kWh. Rate increases over time also varied widely, from a low of 3 percent from 2011 to 2020 for Glendale, to a high of 55 percent over the same period for Palo Alto and Pasadena. **Figure 17** shows residential rates over time. Most of the utilities appear to have ramped up rates using the rate of inflation (2.2 percent).

Palo Alto and Pasadena residential rates, as entered into the CalEERAM model, are identical over the forecast period, which is an extremely unlikely coincidence. A review of the rate schedules on the utilities' respective websites suggests that the rates in Palo Alto's model are probably correct and Pasadena's are too high.<sup>29</sup> Such an error could have arisen if Pasadena

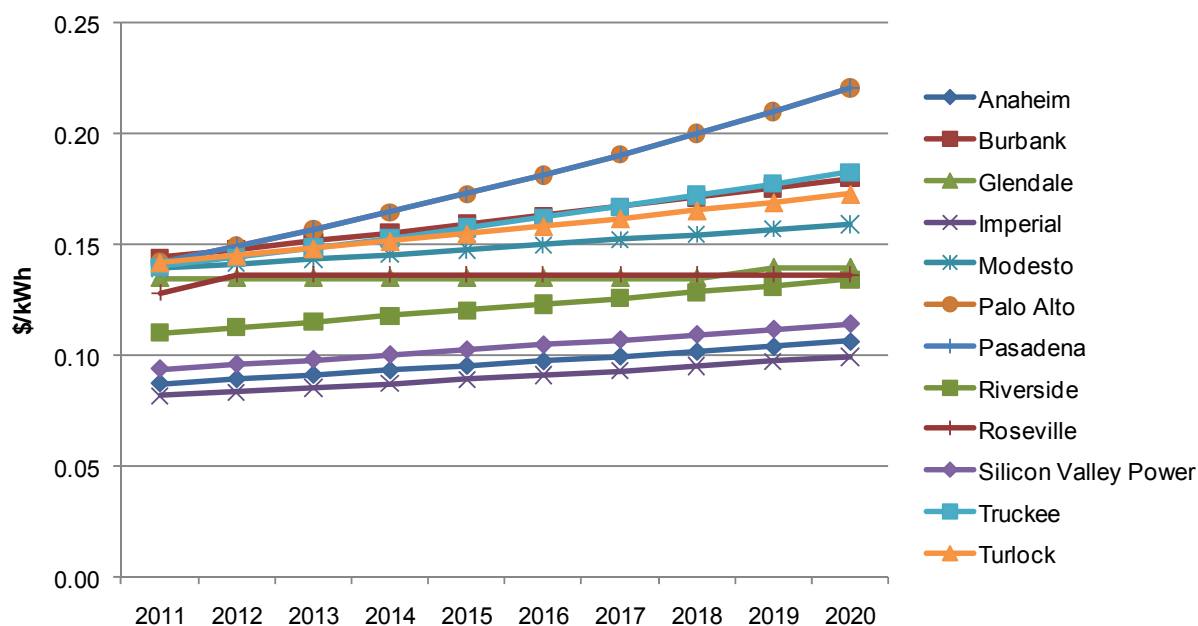
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<sup>29</sup> Energy Commission staff discussed the issue with Pasadena, and Pasadena acknowledged that there appeared to be an error and will correct the model.

used Palo Alto's model as a template and did not update the rates. If Pasadena's model set rates too high, measures would appear to be more cost-effective than they actually are which could affect which measures pass the TRC test and the rates of adoption in estimating market savings potential.

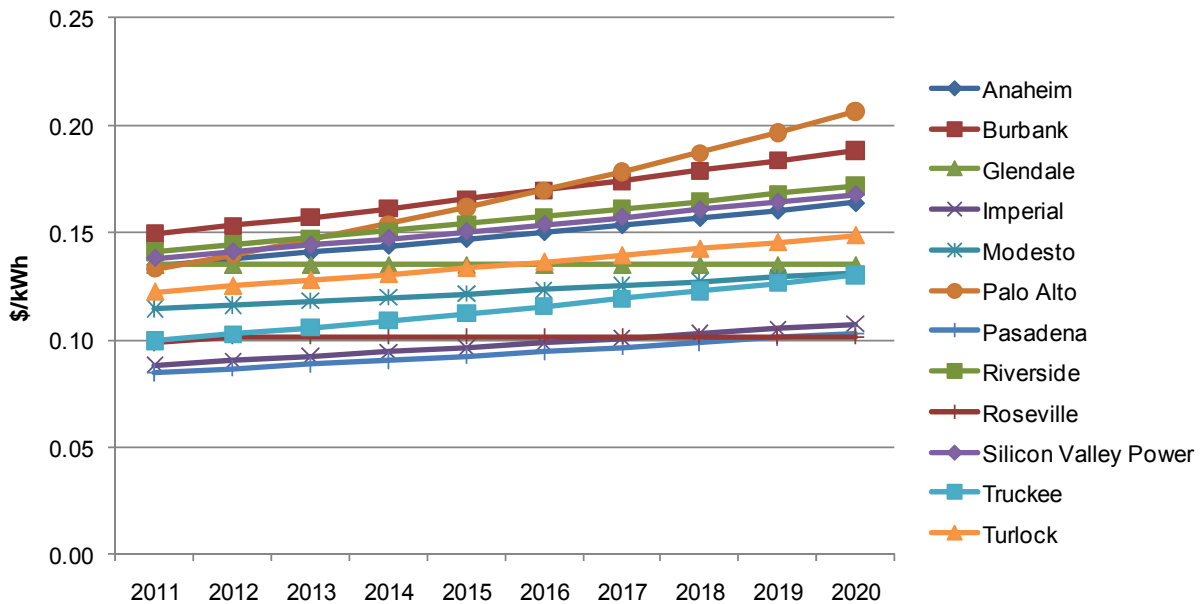
**Figure 18** shows nonresidential energy rates by utility. Rates for 2011 ranged from 8.48 to 14.91 c/kWh across utilities. By 2020, the range opened to 10.16 to 20.62 c/kWh. Glendale's rates were flat over the 2011 to 2020 period, while Palo Alto has climbed 55 percent.

**Figure 17: Residential Energy Rates by Utility**



Source: Data obtained from California Energy Efficiency Resource Assessment Models (October 2010). Data for Truckee obtained from California Energy Efficiency Resource Assessment Models (July 2010).

**Figure 18: Nonresidential Energy Rates by Utility**



Source: Data obtained from California Energy Efficiency Resource Assessment Models (October 2010). Data for Truckee obtained from California Energy Efficiency Resource Assessment Models (July 2010).

Only Riverside and Roseville modeled demand rates for the nonresidential sector. Riverside had a rate of \$11.19 per kW in 2011, and Roseville had a rate of \$5.52 per kW. Potential models often use average energy rates (calculated as revenue divided by kWh energy use) instead of modeling separate energy and demand rates.

A utility's avoided costs are partly the basis for measure cost-effectiveness, determined using the TRC. One can think of avoided cost as the utility's marginal cost of producing one additional unit of electricity. These costs determine the benefit of energy efficiency to the utility. Each unit of energy saved through energy efficiency saves the utility the cost of either producing or purchasing that unit – the avoided cost. While rates differ by sector, avoided costs are the same.

**Figure 19** shows energy avoided costs by utility and period (summer on peak, summer off peak, winter on peak and winter off peak). Ten of the 12 utilities in the detailed study used the same avoided cost forecast (Anaheim, Burbank, Glendale, Imperial, Modesto, Pasadena, Riverside, Roseville, Silicon Valley Power, and Truckee), which was taken from the 2010 E3 Reporting Tool. The chart combines these 10 utilities.

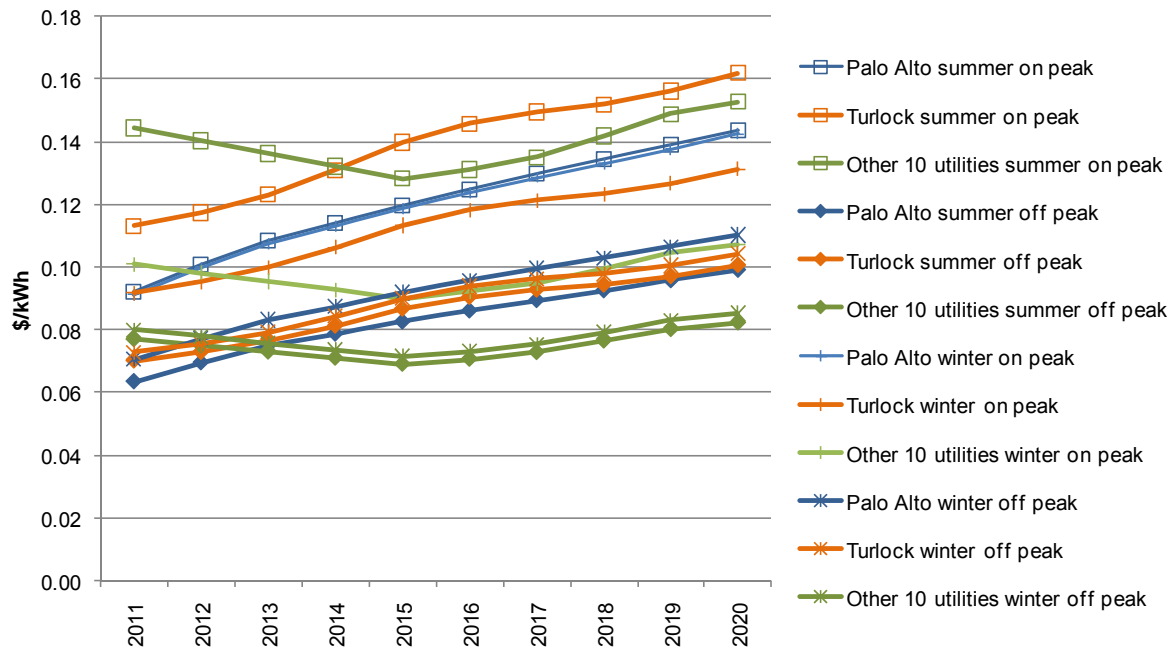
The summer avoided cost forecast for these 10 utilities declines for the first four years of the forecast, and then begins to climb. Both Palo Alto's and Turlock's forecasts show summer avoided costs climbing for the entire 10-year period. Palo Alto's summer and winter on-peak avoided costs are very similar, and Turlock and the other 10 utilities have winter peak costs that are much lower than in summer. Higher avoided costs increase measure cost-effectiveness, which therefore tends to increase economic and market savings potentials. A large difference in

avoided cost could cause only a small change to potentials, however, since only changes to measures with TRCs close to one will affect those potentials.<sup>30</sup>

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<sup>30</sup> A recent KEMA study performed a sensitivity analysis on avoided costs. A 50 percent increase in avoided costs led to a 10 percent increase in economic savings potential (KEMA 2011).

**Figure 19: Avoided Costs by Utility and Period**



Note: The other 10 utilities are Anaheim, Burbank, Glendale, Imperial, Modesto, Pasadena, Riverside, Roseville, Silicon Valley Power, and Truckee

Source: Data obtained from California Energy Efficiency Resource Assessment Models (October 2010). Data for Truckee obtained from California Energy Efficiency Resource Assessment Models (July 2010).

The model's structure includes additional components of avoided cost, including demand and externalities avoided costs. Externalities include costs associated with power plant emissions. It is not clear if or how the model rolls these factors into the current set of energy-avoided costs. Utilities may embed externalities in their estimates of energy avoided costs. Generation, transmission, and distribution capacity costs are typically addressed explicitly through demand-related avoided costs (expressed in \$/kW). These were set at zero for all the utilities studied. Omitting these avoided costs, particularly demand avoided costs, could understate the TRC cost-effectiveness of some measures, causing some measures to fail that could otherwise have passed. This could lead to an artificially low estimate of economic and market savings potential.

### Baseline Consistency

KEMA reviewed energy savings to see if the assumed measure savings values resulted in outputs consistent with total utility energy use. In any bottom-up model, it is necessary to keep sight of the big picture. All of the underlying assumptions about energy use, saturations, building stock, and other factors should be consistent with a utility's overall energy use. While this may seem obvious, an analyst could possibly "not see the forest for the trees" when working extensively at a disaggregated level. Energy use for the various end-use and building-type combinations should add up to total energy use.

KEMA identified just such a baseline issue in Pasadena's model. After a thorough review of Pasadena's calculations, KEMA believes there may be an error in its inputs for offices. Based on the values entered into the model for office floor space (square feet), nonresidential energy use (kWh), and the share of sector energy use by offices, KEMA calculated office energy intensity (kWh per square foot) for Pasadena and compared it with neighboring POU's in Burbank, Glendale, and Anaheim. Pasadena's office energy intensity was about 6 kWh per square foot compared to 15 to 16 for the other three utilities. KEMA also consulted the *California Commercial End-Use Survey* (California Energy Commission 2006), which found energy intensities of 13.25 for small offices and 17.91 for large offices in Southern California Edison's service territory. The data suggest the problem may be a too-high value for office building square footage in Pasadena. Because technology densities are expressed in units per square foot, overstating floor space in a utility service territory would result in overall office potential estimates (technical, economic, and market) that are too high.

If the analysts conducted a baseline analysis for the POU's, they did it outside the CalEERAM model. The model included energy use by sector and percent of sector energy by building type. But, in the model, neither of these was connected to either the number of households or to commercial floor space in a framework that required the various inputs to balance with overall energy use. KEMA lacked the data to perform a rigorous critique, and only the Pasadena model stood out as a problem on this issue.

## Multiple Fuel Types and Interactive Effects

The documentation for the CalEERAM model in the CMUA March report discusses mutually exclusive measures such as SEER 14, 15, or 16+ air conditioners. A model may consider more than one mutually exclusive measure, but a homeowner can install only one such measure in a house at one time. The model must therefore have some mechanism to avoid double-counting. Options to avoid double-counting include adjusting the applicability of the measures so the model applies them to different segments of the population, or evaluating cost-effectiveness and applying the most cost-effective measures, then assessing higher SEER units on an incremental basis. According to CMUA (2010):

Another method is to model only the most efficient of the competing technologies; in the [alternate SEER air conditioning] example above, only SEER 16+. From a conservation potential perspective, this method identifies a larger but still realistic potential. CalEERAM uses this approach to prevent this kind of double counting. (CMUA 2010)

Unfortunately, in the case of most of the utilities studied, this approach did not represent a "larger but still realistic potential." The SEER 16 measure failed the TRC test in every model except in Imperial Irrigation District, which has a particularly hot and dry climate. Roseville substituted a SEER 15 measure, which passed the TRC test, for the SEER 16 measure in the default list. The remaining 10 utilities showed no economic or achievable savings for central air conditioning in single-family homes since the SEER 16 measure failed the TRC test. These utilities should have done what Roseville did: Seeing that the SEER 16 failed, they should have

evaluated a SEER 15. If that failed, they should have evaluated a SEER 14 unit to accomplish the goal stated in the document.

Measures sometimes save energy from multiple fuel sources. For example, insulated ducts could save both natural gas and electricity by decreasing heating and air-conditioning loads. For utilities with both gas and electric programs, it is usually a clear choice to allocate costs between the two to reflect the fact that both gas and electricity savings accrue. Of the POUs studied, only Palo Alto offers both gas and electric service. Palo Alto allocated full costs of the measure to the electricity analysis. This understates the participant benefits because they do not account for natural gas savings.

Utilities with only electricity programs may allocate the full measure cost to electricity savings. This results in accurate costs and benefits for the utility, but it distorts benefits and costs for the participant (since it includes all the costs but only the electricity benefit). As a result, the model's estimate of measure adoption (based on measure payback in the CalEERAM model) is lower than it would be if the model accounted for the full benefit to the participant. Lower adoption results in less savings for the affected measures.

Some efficiency measures will have interactive effects across multiple end uses. For example, incandescent light bulbs give off far more waste heat than light-emitting diode (LED) or compact fluorescent lighting (CFL) bulbs, so replacing significant numbers of incandescent lamps with either CFLs or LEDs will measurably decrease a building's summer cooling load and increase the winter heating load. This effect will therefore diminish the savings potential of air conditioning measures and increase potential savings from heating measures. Similarly, shell measures reducing a building's solar heat gain (window film, cool roofs) reduce cooling loads but increase heating loads.

The California Database for Energy Efficiency Resources (DEER), which includes interactive effects, is the basis for the E3 Reporting Tool's savings. KEMA believes the CalEERAM model appropriately captures these effects.

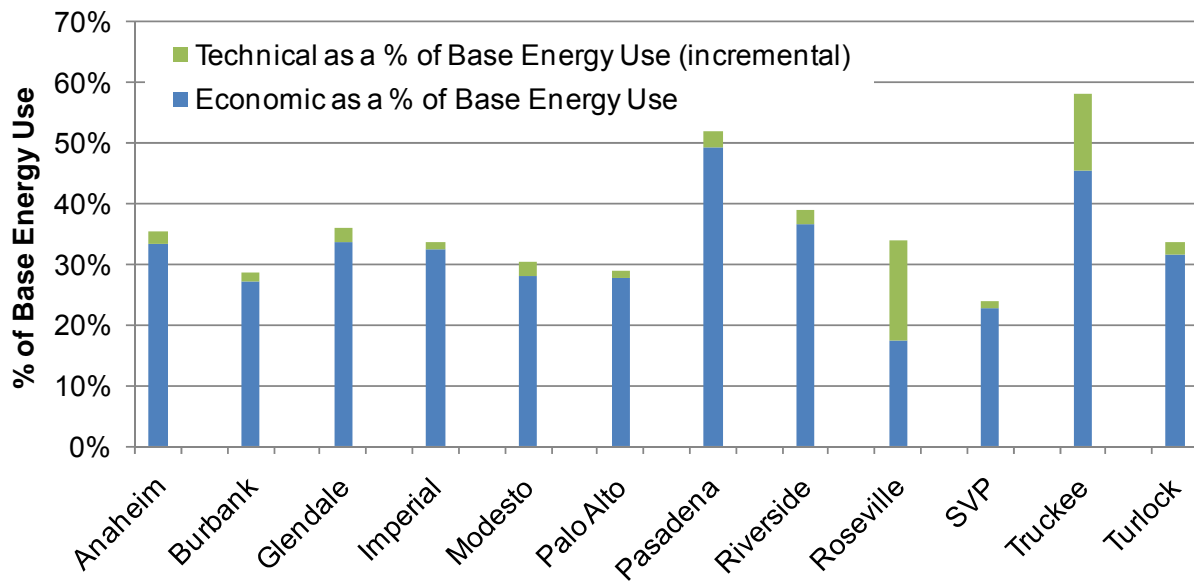
## Outputs

The following sections present the outputs of the CalEERAM models for the 12 utilities in the detailed study. These include both technical and economic savings potential savings. This section also presents and compares utility targets, most of which were based on the CalEERAM market savings potentials.

### Technical and Economic Potential Savings

**Figure 20** compares technical and economic savings expressed as a percentage of each utility's energy use. Pasadena's and Truckee's technical and economic savings potentials are high compared with other utilities. This result led KEMA to discover that Pasadena's office floor space is inconsistent with its energy use estimate. (The issue is discussed above under Baseline Consistency.) If Pasadena did overstate its office floor space, it would increase savings estimates for both that building type and for savings overall.

**Figure 20: Technical and Economic Savings in 2011 as a Percentage of Energy Use, by Utility**



Source: Data obtained from California Energy Efficiency Resource Assessment Models (October 2010). Data for Truckee obtained from California Energy Efficiency Resource Assessment Models (July 2010). Base energy use data obtained from California Municipal Utilities Association, *Energy Efficiency in California's Public Power Sector. A Status Report*, March 2010.

Ground-source heat pumps account for 35 percent of Truckee's residential technical savings potential and 9 percent of its nonresidential technical savings potential. Unlike the other utilities studied, Truckee has a winter peak, so therefore it considered heating savings in its ground-source heat pump calculations. (The other utilities used cooling savings only.) Truckee found the measure to be cost-effective and is included in the analysis. This one factor seems to explain Truckee's high technical and economic savings potential. When reviewers explicitly excluded ground-source heat pumps from Truckee's analysis, economic savings potential dropped from 46 percent to 32 percent, a value in line with most of the other utilities.

Is the high potential estimate for ground-source heat pumps reasonable for Truckee? According to Truckee's utility staff, only 5 to 10 percent of homes and less than 5 percent of commercial buildings use electricity as their primary heating source.<sup>31</sup> The model assumes a 50 percent electric fuel share for residential ground-source heat pumps and 10 percent for commercial, suggesting that the potential may be significantly overstated.

Most of the utilities show only a small decrease from technical to economic savings, with more than 90 percent of the technical savings captured as economic savings. Two utilities stand out, however: Roseville shows economic savings at only 51 percent of technical savings, and

<sup>31</sup> Personal communication, February 22, 2011, via e-mail.

Truckee shows economic savings at 78 percent. Silicon Valley Power showed a similar result in the first model reviewed (from July 2010), but not in the October 2010 revision.

Their choice to explicitly exclude measures from the calculation of economic savings potential drives the large gap between technical and economic savings potentials for Roseville and Truckee, as discussed above (see **Table 13**).

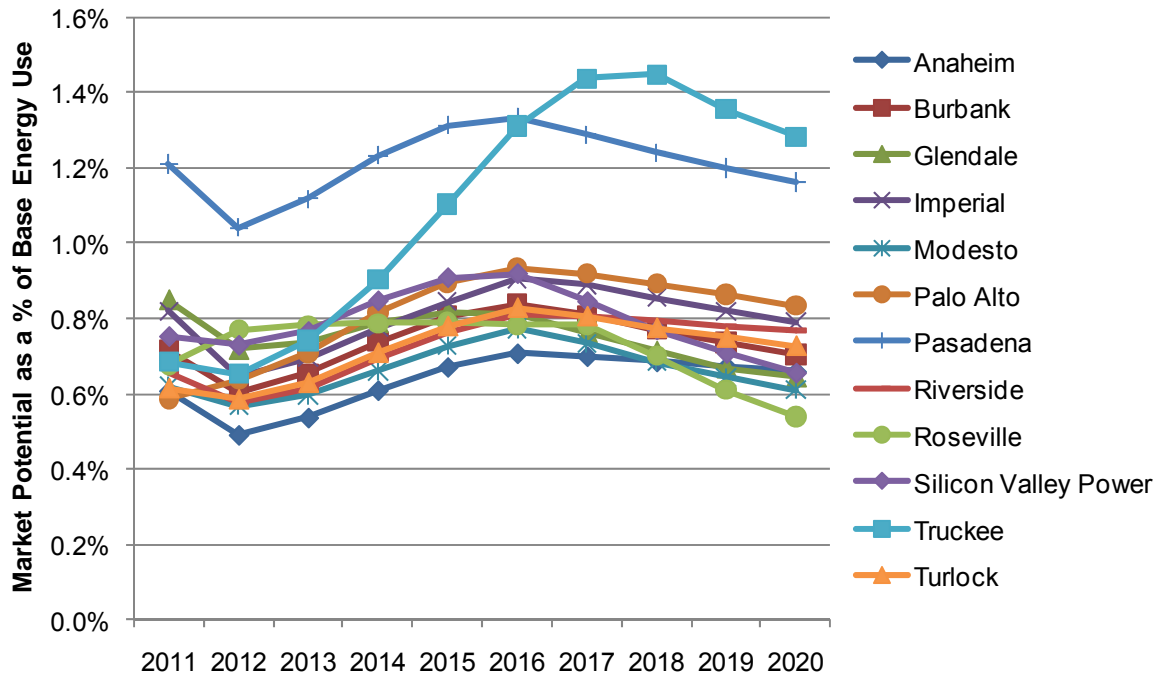
### Market Potential

**Figure 21** shows the market savings potential from the revised CalEERAM models (October 2010).<sup>32</sup> From 2011 to 2012, most of the utilities show a decrease in market savings potential from the effect of lighting standards. The standards require increased efficacy, which increases baseline efficiency and reduces the savings potential for efficient lighting, notably for CFLs. Most of the utilities show savings ramping up over four to five years starting in 2012, and then declining. This pattern can occur as retrofit measures saturate the market, resulting in fewer savings opportunities later in the program. In practice, advances in technology – efficiency improvements, new technologies, or cost reductions in existing efficient technologies – create new opportunities that the utility incorporates into the program, while they phase out measures that have largely saturated the market. Some potential models attempt to model such technological changes, but many do not due to the high degree of uncertainty and a lack of analytical rigor. The CalEERAM model adopted the more conservative approach of including only established technologies.

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32 Except for Truckee Donner, which did not provide a revised model. Truckee's market savings potentials are from the model it provided in July 2010, which includes the effects of the error.

**Figure 21: Market Potential as a Percentage of Energy Use, 2011-2020**



Source: Data obtained from California Energy Efficiency Resource Assessment Models (October 2010). Data for Truckee obtained from California Energy Efficiency Resource Assessment Models (July 2010). Base energy use data obtained from California Municipal Utilities Association, *Energy Efficiency in California's Public Power Sector. A Status Report*, March 2010.

Pasadena and Truckee estimate significantly higher market savings potential than the other utilities, as a percentage of electricity use. Pasadena's result and its high technical savings potential are directly related, as previously discussed. KEMA did not identify any additional factors that might have increased Pasadena's market savings potential. Ground-source heat pumps drive Truckee's market savings potential, like its technical savings potential. Eliminating ground-source heat pumps from the analysis took its market savings potential down to 0.63 percent of energy use in 2011. That potential then increased to a high of only 0.85 percent in 2016, and then declined.

Palo Alto, Roseville, and Silicon Valley Power are the only utilities that do not show a marked drop in potential between 2011 and 2012. Palo Alto and Silicon Valley Power have the lowest shares of residential energy use of all the utilities studied, at 16 percent and 9 percent, respectively. Nonresidential savings potential therefore dominates their overall potentials, and nonresidential savings potential does not typically show the same dip as residential savings potential. This is because CFLs are a less significant measure in the nonresidential sector. Roseville excludes residential CFLs from its entire analysis, which eliminates the largest factor in the decline.

There is some evidence that market savings potentials may not be strictly comparable between utilities. The model is designed so that each utility can calibrate the results based on its past

program experience (level of savings relative to program costs, for example) using an input called the calibration target. This calibration is often a step in estimating market savings potentials and helps to account for local market receptivity to program efforts.

If the utilities calibrate the models to “business-as-usual” incentive levels, budgets, and savings, the model will produce business-as-usual results unless they set incentive levels at different levels. If a utility has underinvested in energy efficiency in the past (as measured by its failure to meet its past targets), this process can be used inappropriately to validate and reinforce that underinvestment.

Only a few of the utilities modeled incentive levels higher than business as usual, suggesting that estimated potentials do not represent what could be achieved with a more aggressive program approach.

To test the sensitivity of market potentials to utility program effort, KEMA reran the CalEERAM model assuming 75 percent incentives for all end uses (in place of the incentives originally assumed by the POU's). **Table 15** compares the resulting market savings potentials with the market savings potentials published in the CMUA's 2010 report. Market savings potentials are much higher with 75 percent incentives, with all but one of the 12 POU's meeting the 10 percent savings goal of AB 2021.

**Table 15: Comparison of Published Market Potential With Market Potential Calculated Using 75 Percent Incentives**

Utility	Market Potential as Stated		Market Potential at 75% Incentives	
	Cumulative GWh to 2020	Cumulative % of Energy Use to 2020, % of Forecasted 2020 Energy Use	Cumulative GWh to 2020	Cumulative % of Energy Use to 2020, % of Forecasted 2020 Energy Use
Anaheim	175,053	6.1%	335,867	11.8%
Burbank	93,934	7.1%	158,964	12.0%
Glendale	86,300	7.4%	173,404	14.8%
Imperial	335,172	7.7%	603,313	13.9%
Modesto	187,955	6.1%	332,003	10.8%
Palo Alto	79,743	7.9%	120,655	12.0%
Pasadena	166,137	11.4%	292,035	20.0%
Riverside	171,367	6.7%	331,972	12.9%
Roseville*	94,230	6.7%	100,661	7.2%
Silicon Valley Power	26,1286	7.5%	393,569	11.2%
Truckee	19,880	10.1%	35,039	17.9%
Turlock	148,826	5.9%	269,164	10.8%

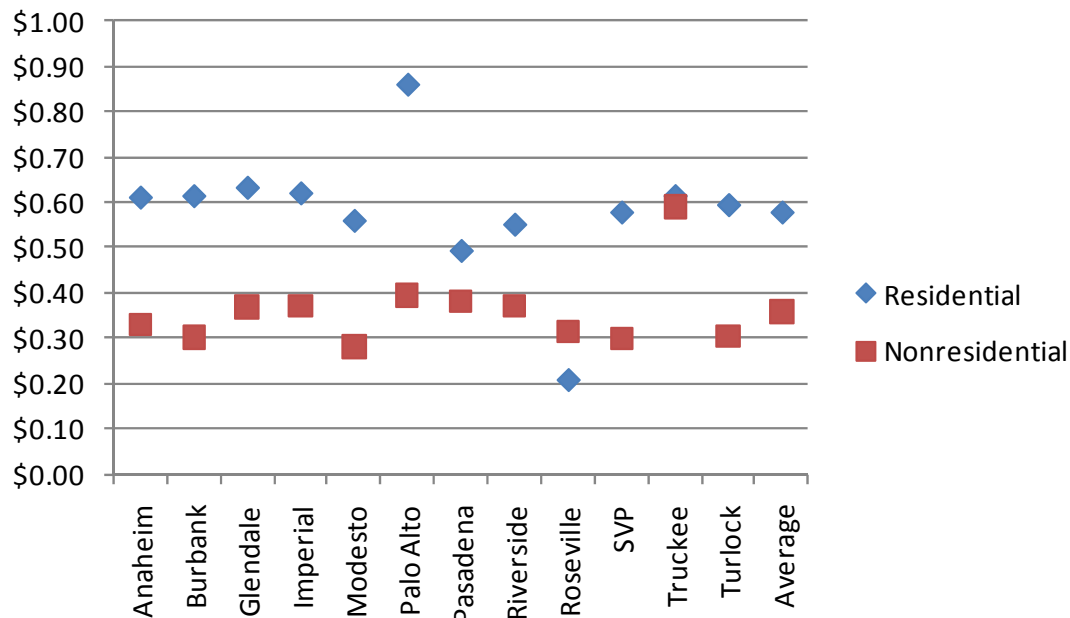
\*Altering Roseville's model so that in addition to using 75 percent incentives, it followed a straight TRC rule for including measures, the cumulative savings would be 118,327 GWh or 8.5 percent of 2020 forecasted energy use.

Source: Analysis based on California Energy Efficiency Resource Assessment Models (October 2010). Analysis for Truckee based on California Energy Efficiency Resource Assessment Models (July 2010). Base energy use data obtained from California Municipal Utilities Association, *Energy Efficiency in California's Public Power Sector. A Status Report*, March 2010.

Not all the utilities calibrated to business as usual. On a conference call in August 2010, a representative of one of the utilities said that it used the calibration target to produce market savings potentials that met the requirements of AB 2021 (10 percent savings over 10 years) rather than calibrating to past program experience. In this case, the “market savings potential” is not a market savings potential at all. If the utilities calibrate the model to a higher potential level without adjusting incentive levels, as was the case here, the approach results in higher market potentials than observed data support. Also, such a “market savings potential” is not comparable to the market savings potential of utilities that did calibrate to past program experience. Pasadena, Glendale, and Truckee clearly did not calibrate to targets, since they set their targets independently of market savings potential. For the remaining utilities, it is not clear from the model which approach they used. This confusion makes it difficult to make useful comparisons of market savings potential estimates across utilities.

**Figure 22** shows the program cost that the model calculates for the market savings potentials above (first year savings), for Year 5 of the program. Most of the POU's have similar costs per kWh within each sector. In the residential sector, Palo Alto's cost is particularly high at 86 cents per first-year kWh saved, while Roseville's is at the other extreme, at only 21 cents per kWh. Roseville's market savings potential is calculated assuming only extremely low residential incentives and limited residential measures. Palo Alto's model assumes an administrative cost factor at twice the level of the other utilities. In the nonresidential sector, Truckee's cost per kWh is unusually high at 59 cents, but this may be a result of the error in the July version of the model. (Truckee was the only utility studied that did not provide a revised model.)

**Figure 22: Residential and Nonresidential Program Costs per First-Year kWh Saved for Year 5 of Program**



Source: Data obtained from California Energy Efficiency Resource Assessment Models (October 2010). Data for Truckee obtained from California Energy Efficiency Resource Assessment Models (July 2010).

### Adopted Targets

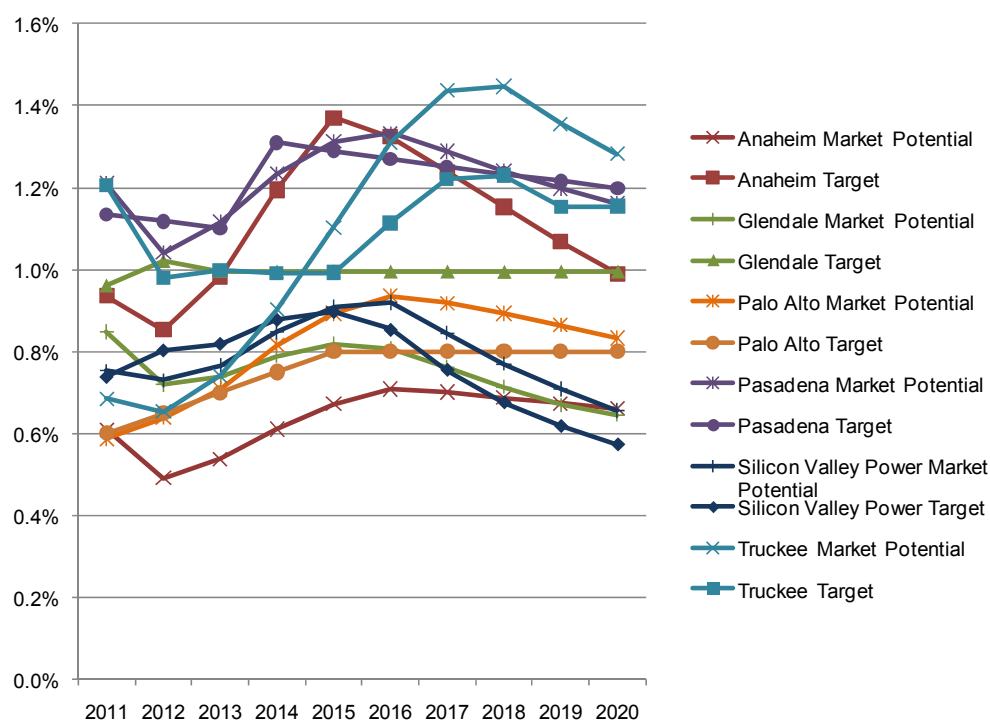
Eight of the 12 utilities in the detailed study published targets in CMUA's March 2010 report that matched the July versions of the CalEERAM models provided to KEMA. This seems to indicate that most utilities intended to set targets equal to the estimated market savings potential. The remaining four utilities, Glendale, Palo Alto, Pasadena, and Truckee, set targets that are different from the March 2010 market savings potential. However, due to revisions to the model, the market savings potential from the October versions of the model differs from targets for all the utilities.

**Figure 23** and **Figure 24** show adopted targets and market savings potentials for 12 of the largest POUs. For charting clarity, the first chart groups the utilities with higher targets together, and the second chart groups those with lower targets. Because Glendale, Palo Alto, Pasadena, and Truckee set targets different from the original market savings potentials, they show a greater divergence between targets and market savings potentials in the first chart. For most of the utilities with lower targets, the targets track the shape (if not the magnitude) of the market savings potential despite revisions to the model that correct the data error in the nonresidential calculations. Silicon Valley Power, which has a higher share of nonresidential energy use, and Roseville, which has a greater program focus on nonresidential, showed greater changes to the shape of the target trajectory compared with market savings potential. While Imperial Irrigation District based its targets on its initial market savings potentials, it later

increased its market savings potential by 65 percent, as shown in **Figure 24**. The result is a far larger gap between market savings potential and target than for most of the other POU.

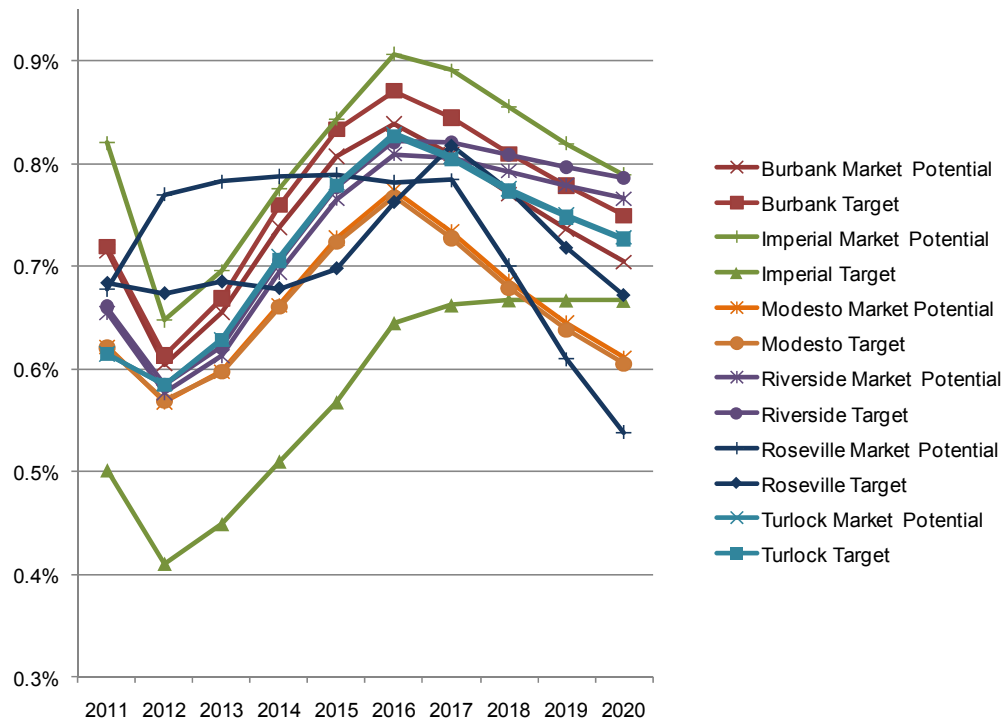
Anaheim and Glendale's targets are significantly higher than their estimated market savings potentials. They join Pasadena and Truckee as the only utilities with targets at or above 1 percent per year for most years. This may represent a deliberate effort on the part of Glendale and Anaheim to set targets that comply with the goals of AB 2021.

**Figure 23: Comparison of Targets and Market Potentials as a Percentage of Energy Use: Anaheim, Glendale, Palo Alto, Pasadena, Silicon Valley Power, and Truckee**



Source: Data obtained from California Energy Efficiency Resource Assessment Models (October 2010). Data for Truckee obtained from California Energy Efficiency Resource Assessment Models (July 2010). Targets and base energy use data obtained from California Municipal Utilities Association, *Energy Efficiency in California's Public Power Sector. A Status Report*, March 2010.

**Figure 24: Comparison of Targets and Market Potentials as a Percentage of Energy Use: Burbank, Imperial, Modesto, Riverside, Roseville, and Turlock**



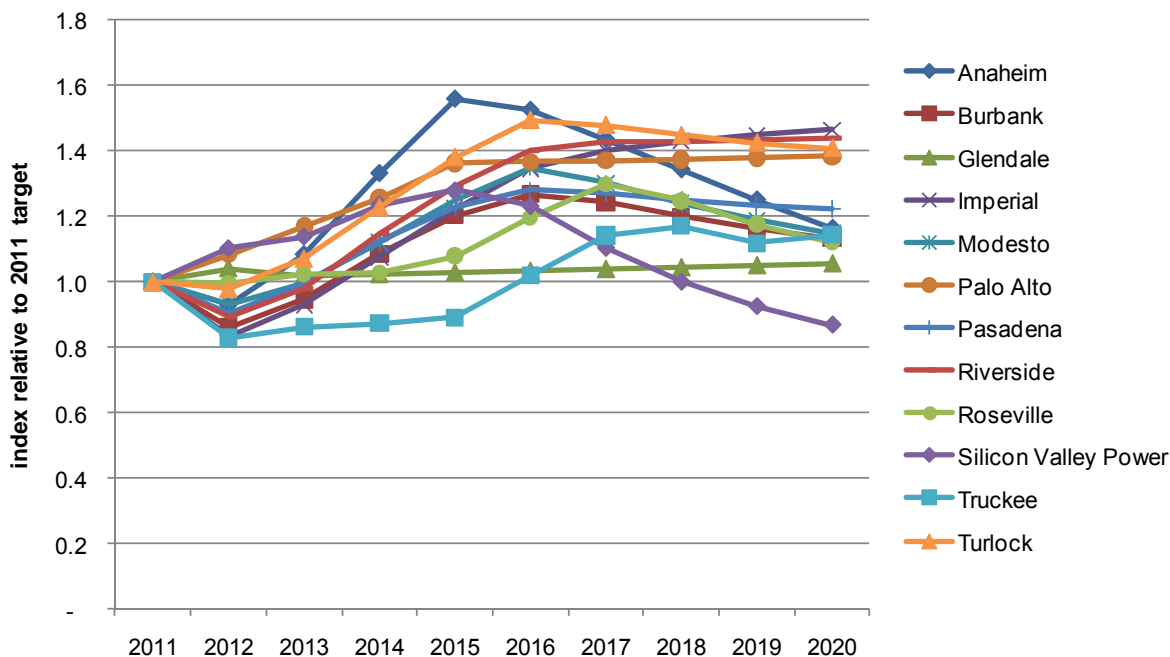
Source: Data obtained from California Energy Efficiency Resource Assessment Models (October 2010). Data for Truckee obtained from California Energy Efficiency Resource Assessment Models (July 2010). Targets and base energy use data obtained from California Municipal Utilities Association, *Energy Efficiency in California's Public Power Sector. A Status Report*, March 2010.

Truckee's divergence between the March 2010 targets and its market savings potential are not due to the correction in market potentials discussed above; the targets and market savings potentials from the model KEMA received in July both agree with the March 2010 report. Truckee's target is 76 percent higher than its estimated market savings potential in 2011. However, the sum of the annual targets from 2011 to 2020 is equal to the sum of the market savings potentials for the same period, suggesting that Truckee smoothed out its targets over time while matching the market savings potential in total. While its market savings potentials are much lower than 1 percent in the early years, growing to almost 1.5 percent in 2018, it has flattened out its targets to 1 percent to 1.2 percent each year.

**Figure 25** shows utility targets over time as an index relative to the 2011 targets. This removes the influence of overall growth in energy use and shows how MWh targets are changing over time, which also corresponds to how quickly efficiency programs must be ramped up to meet the adopted targets. Glendale and Truckee's initial targets were high but have modest growth. Silicon Valley Power is the only utility with overall targets lower in 2020 than in 2011. Anaheim has the steepest rate of increase between 2012 and 2015, with a 19 percent increase over that period. Burbank, Imperial, Modesto, Pasadena, Riverside, and Turlock all have periods where targets increase by 10 to 15 percent per year. While these rates of increase are moderately

aggressive, KEMA believes they are feasible with some additional staffing and program offerings.

**Figure 25: Targets Over Time Relative to Base Year**



Source: Data obtained from California Municipal Utilities Association, *Energy Efficiency in California's Public Power Sector. A Status Report*, March 2010.

### Consistency Between Studies

There was a high degree of consistency between the CalEERAM models for the different POU's. **Table 16** summarizes the degree of agreement between models for various inputs. The inputs section discusses these in greater, above. Some utilities, notably Roseville, Palo Alto, Truckee, and Turlock, had a higher level of deviation from the norm. This may reflect a greater availability of local information or a greater interest in customizing the model using local information.

**Table 16: Consistency Between POU Model Inputs**

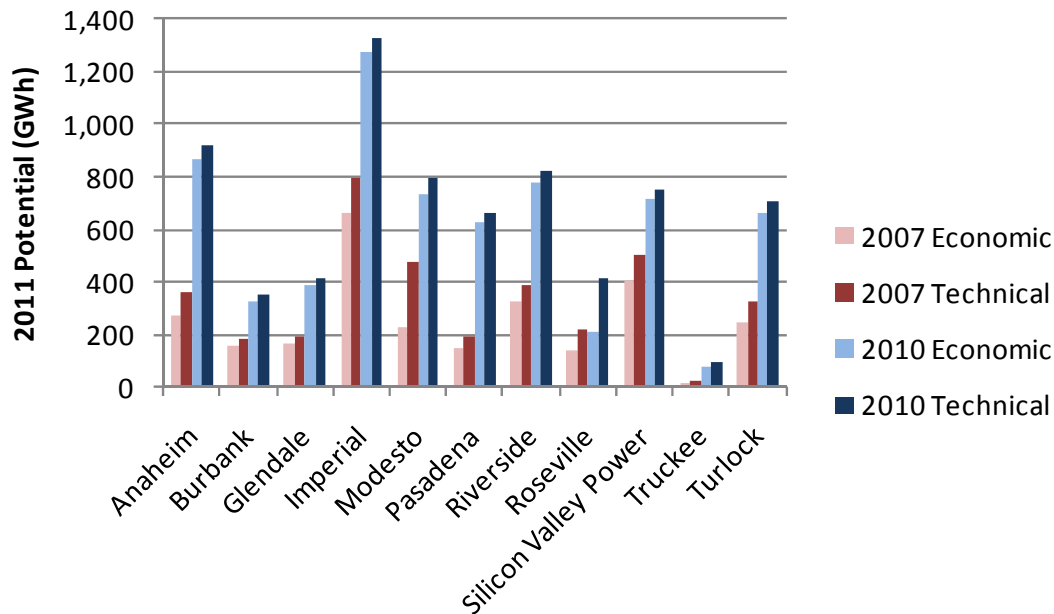
<b>Input</b>	<b>Degree of Agreement</b>	<b>Exceptions</b>
Rates	Low	
Avoided costs	High	Palo Alto, Turlock
Decision curve parameters	High	Roseville
Residential incentive levels	High	Roseville, Truckee, Turlock
Nonresidential incentives levels	High	Roseville
Inflation rate	High	None
Utility discount rate	High	None
Line loss rates	High	Anaheim, Palo Alto
Admin. costs (\$/kWh saved)	High	Palo Alto, Turlock
Measure lists	High	See <b>Table 13</b> and <b>Table 14</b>

Source: Analysis based on California Energy Efficiency Resource Assessment Models (October 2010). Analysis for Truckee based on California Energy Efficiency Resource Assessment Models (July 2010).

### Consistency With Previous Potential Estimates

KEMA found significant differences between the most recent technical and economic savings potential estimates from the CalEERAM model and the potentials produced in 2007, with technical and economic savings potential estimates more than doubling for many utilities between the 2007 and 2010 studies. **Figure 26** shows that Pasadena and Truckee's estimates of economic savings potential increased by a factor of four.

**Figure 26: Comparison of 2007 and 2010 Estimates of Technical and Economic Potential in 2011**



Note: Palo Alto is omitted from the chart because it did not estimate potentials in 2007.

Source: Data for 2007 obtained from California Municipal Utilities Association, *Establishing Energy Efficiency Targets: A Public Power Response to AB2021. Final Update*. October 2007. Data for 2010 obtained from California Energy Efficiency Resource Assessment Models (October 2010). Data for Truckee 2010 obtained from California Energy Efficiency Resource Assessment Models (July 2010).

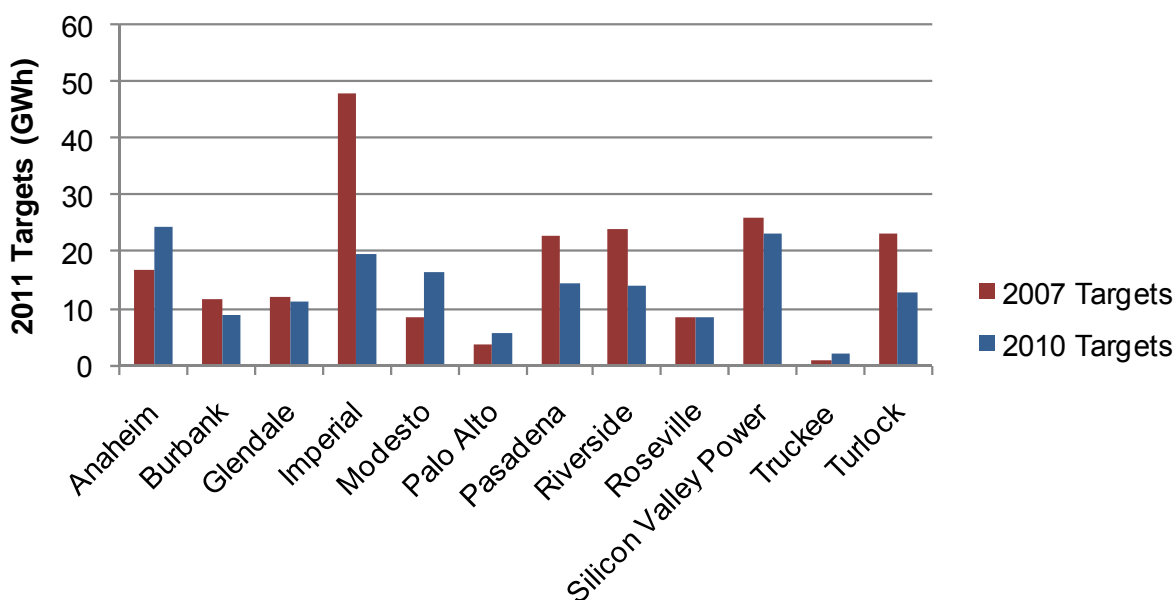
Did POU savings potential really increase that much? It seems unlikely that the technological changes between 2007 and 2010 could account for so large a change. It is far more likely that the change is due to differences in how the utilities modeled the potential. The 2007 model was a top-down model that used savings estimates from another potential study and adjusted them based upon POU energy use and customer characteristics. The CalEERAM model, in contrast, is a bottom-up model that begins with measure level assumptions and combines savings over the customer population to estimate total savings. The 2007 model was not available for review, so an explicit comparison between the 2007 and 2010 models was not possible.

In interviews, some POU representatives expressed dissatisfaction with the potential models. They especially criticized the 2007 model, but few utilities found either model useful for program planning because they did not believe the results accurately represented the unique characteristics and energy efficiency concerns of their service population. Most utilities made few changes to the default assumptions of the model, likely reflecting a lack of interest in the model and its results rather than an endorsement of its defaults. In fact, POUs seem to have

little faith in the results because they base many assumptions on California statewide or IOU data. Many saw estimating potential as a regulatory requirement the POUs must fulfill rather than as a useful tool for efficiency planning.

In spite of the drastic increase in estimates of technical and economic savings potential, targets set in 2010 did not show a similar pattern compared with targets set in 2007. **Figure 27** compares the original target for 2011, set in 2007, along with the revised target, set in 2010. Four of the utilities increased their targets, seven decreased their targets, and Roseville's target remained essentially the same. Imperial Irrigation District showed the largest decrease, at 59 percent. Truckee had the largest increase by percentage and nearly doubled its targets.

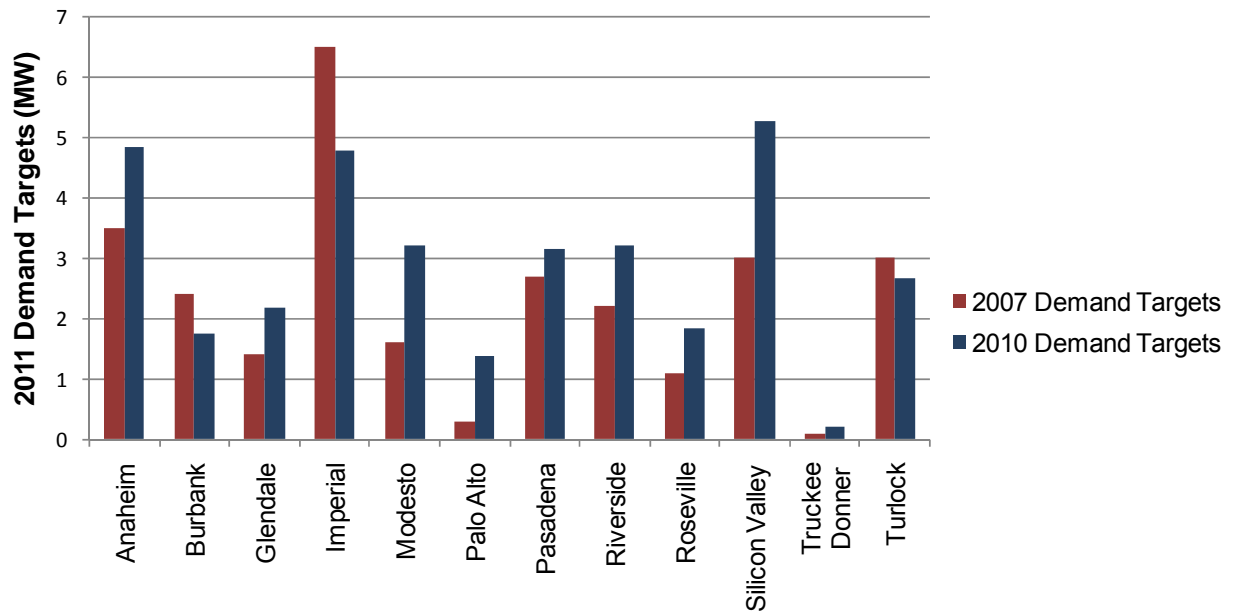
**Figure 27: Comparison of 2007 and 2010 Energy Reduction Targets for 2011**



Source: Data from 2010 obtained from California Municipal Utilities Association, *Energy Efficiency in California's Public Power Sector. A Status Report*, March 2010. Data from 2007 obtained from California Municipal Utilities Association, *Establishing Energy Efficiency Targets: A Public Power Response to AB2021. Final Update*. October 2007.

**Figure 28** shows that the demand reduction targets adopted in 2007, compared with the demand reduction market savings potentials reported in 2010. Most of the 12 POUs examined increased their estimates of demand reduction potential in their service territories except for Burbank, Imperial, and Turlock.

**Figure 28: Comparison of 2007 and 2010 Demand Reduction Targets for 2011**



Source: Data from 2010 obtained from California Municipal Utilities Association, *Energy Efficiency in California's Public Power Sector. A Status Report*, March 2010. Data from 2007 obtained from California Municipal Utilities Association, *Establishing Energy Efficiency Targets: A Public Power Response to AB2021. Final Update*, October 2007.



## CHAPTER 5: Individual Utility Results—Assessment of Potential Estimates and Energy and Peak Targets for Utilities

This chapter details and discusses of the potentials and targets for each of the 12 publicly owned utilities (POUs) reviewed in detail for this study.<sup>33</sup> Each section includes an assessment of the targets according to the criteria set forth in AB 2021, specifically that they are cost-effective, feasible and reliable and that they meet the goal of reducing energy use by 10 percent over 10 years.

The TRC test, a metric that includes the benefits and costs to both the utility and program participants, measures cost-effectiveness. The test compares the net present value, in dollars, of the forecasted energy and peak savings benefits with the customer and program costs of a measure or program. A TRC ratio greater than one indicates that the energy efficiency investment is cost-effective.

When comparing two cost-effective programs, a higher TRC ratio does not necessarily indicate a *better* program. A program with a very high TRC ratio may be pursuing only the most cost-effective measures at the expense of savings potential from worthy, less cost-effective measures. An aggressive program that pursued all cost-effective opportunities could have a lower TRC ratio but higher overall savings. The analyst must base the tradeoff of cost-effectiveness versus overall savings upon an assessment of uncertainties in the TRC ratio, overall utility strategy, and public policy goals.

In addition to TRC, KEMA looked at program expenditures for first-year kWh saved. Unlike the TRC test, this metric does not consider participant costs. It does provide an additional metric for cost-effectiveness that can be compared with utility prices.

Reviewers looked at the utilities' current programs and processes in assessing the feasibility of their targets. In particular, they analyzed staffing levels and staff experience; funding process and budget cycles; and whether the utilities' governing boards have adopted the proposed targets. They examined targets in the context of both estimated market savings potential and a utility's record of program savings from 2006 to 2009. In some cases, the targets exceeded the estimated market savings potential, a finding that questions the feasibility of the targets themselves. Staff additionally reviewed targets that are high relative to historical savings to ensure that program plans and funding levels support the proposed increase. Reviewers also looked at how quickly the proposed targets increase over time, and whether the program, funding, and staffing plans support the ramp-up.

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33 The 12 utilities in this analysis are Anaheim, Burbank, Glendale, Imperial Irrigation District, Modesto, Palo Alto, Pasadena, Riverside, Roseville, Silicon Valley Power, Truckee Donner, and Turlock Irrigation District.

The reliability assessment considered two factors. First, has the utility consistently delivered its projected savings? That is, has the utility accurately forecast its savings for the following year? The second factor is whether the utility has assessed its program accomplishments through a rigorous EM&V process. There can be a significant difference between ex ante estimates of program savings and savings estimates from actual evaluations. Potential issues include inappropriate ex ante estimates of measure savings, improper measure installation, differences in operating hours, fraud, or free ridership that is either higher or lower than planning assumptions. EM&V provides an accurate estimate of past program savings and should therefore allow the utility to improve its future program savings estimates.

The statewide energy reduction goal of AB 2021 is 10 percent of base energy use over 10 years. Reviewers compared targets against this goal to see which utilities achieved this target and which ones did not.

The discussion of each utility includes the following:

- Summary of revised targets—This section uses data from the March 2010 CMUA Report to describe the 2011-2020 adopted savings targets relative to previous targets, electricity use, and new market savings potential estimates.
- Key analytical differences from other utilities—this section highlights features in the utility's CalEERAM savings potential analysis that might explain quantitative differences between its savings potentials and targets, and those of other utilities.
- Technical and economic savings potential—this section presents revised 2010 CalEERAM estimates of technical and economic energy savings potential, and peak demand savings potential from 2011 through 2020.
- Market savings potential and targets— this section uses data from the March 2010 CMUA Report, the October 2007 CMUA Report, and the revised 2010 CalEERAM estimates. It presents savings targets as a percentage of economic savings potential and compares new utility targets to past targets, past program accomplishments, and market savings potential estimates.
- Market savings potential by end use—Charts break down revised 2010 CalEERAM estimates of market energy (MWh) and demand (kW) savings potential by major end-use categories. This shows which end use categories have the greatest savings opportunities, information that can be valuable in program planning.
- Program factors affecting target feasibility and reliability—KEMA and the California Energy Commission assessed current utility energy efficiency programs, and interviewed utility representatives about program plans in order to assess their ability to meet the proposed targets. This section reports the findings of this research.
- Program cost-effectiveness —this section presents the revised 2010 CalEERAM estimated total resource cost and the cost per first year kWh savings for the utility's overall energy efficiency program.

- **Targets' contribution to energy use reduction**—This section shows the utility's 2011-2020 annual efficiency savings targets as a percentage of energy use from the March 2010 CMUA Report. If this metric is about 1 percent for each year of the forecast period, the utility remains on track to achieve the AB 2021 use reduction goal. This section also reports the final cumulative savings over 10 years as a percentage of energy use, the key metric for determining if targets meet AB 2021 goals.
- **Assessment of targets**—On the basis of the findings in the previous sections, reviewers evaluate the utility targets by their cost-effectiveness, feasibility, reliability, and ability to meet the energy use reduction target; they also provide a summary of target adequacy.
- **Options for increasing efficiency**—in cases where the utility fails to meet the AB 2021 energy use reduction target, this section provides concrete recommendations for strategies the utility could use to increase savings.

Energy savings targets for 2011-2020 in this chapter are from CMUA's March 2010 report. Market, economic, and technical savings potentials are from the revised October 2010 CalEERAM models. Energy savings targets for 2007-2016 are from CMUA's October 2007 Report.

Most of the utilities, with the exception of Glendale, Palo Alto, and Truckee, set their energy savings targets for 2011-2020 to the market savings potentials that they developed with the CalEERAM model for the March 2010 CMUA Report. When the utilities revised the CalEERAM models in October 2010, the new market savings potentials changed from the adopted targets for all the utilities. The apparent intent of most of the utilities in the detailed study (Anaheim, Burbank, Imperial, Modesto, Riverside, Roseville, Silicon Valley Power, and Turlock) was to set targets equal to the CalEERAM market savings potential estimates.

## **Overarching Issues**

### **Effects of the Economic Downturn**

Many of the utilities report that electricity use declined in the wake of the recent economic downturn. The forecast used to populate the CalEERAM model does not capture this decline and is therefore higher than the current POU forecasts. Targets that seemed reasonable in the original energy use forecast may now seem aggressive.

The decline in energy use represents a barrier to meeting utility targets. There is also continuing uncertainty about how long the economic downturn could continue to depress electricity use.

### **Interpreting Targets as a Percentage of Economic Savings Potential**

Several factors affect how quickly programs can realize economic savings potential.

Many measures are replace-on-burnout measures. That is, customers install them when the old equipment fails – for example, when a high-efficiency air conditioner replaces an old unit that failed. These measures enter the market slowly as existing stock turns over. Since many types of equipment have lifetimes of 10 to 20 years, this measure can, at most, capture annual economic savings of 5 to 10 percent.

Customer awareness is also a critical factor. A customer needs to be aware of the benefits of a high-efficiency purchase. This awareness requires the knowledge of both the existence of a new technology and an understanding of its savings potential. A key goal of efficiency programs is to increase public awareness of the consumer benefits of high efficiency measures. It can take several years for programs like these to reach high levels of customer awareness.

Patterns of technology adoption have been the subject of thorough studies and documentation. Some consumers like to own the newest technologies and become early adopters; others see new technology as currently unnecessary or unreliable and lag behind. This difference determines, in part, how slowly or quickly new technologies penetrate the market. If consumers need to replace failing equipment before a new technology has proven itself to their satisfaction, they will choose the equipment with which they are comfortable, even if it is less efficient.

Because of these factors, market savings potential, from which most utilities set their savings targets, can realistically capture only a fraction of economic savings potential each year. Market to economic savings potential ratios of 2 percent to 5 percent in a given year is typical.

## Anaheim

### Summary of Revised Targets

Efficiency savings for Anaheim Public Utilities (Anaheim) in fiscal year 2008/2009 represented 4 percent of all POU (including SMUD) and LADWP) energy efficiency savings (CMUA 2010).

Anaheim's 2007 targets represented a significant increase over its 2006 program savings.

Although its savings fell short of its target in 2007, by 2008 and 2009, Anaheim met targets set in 2007. Anaheim's new targets for 2011 and 2012 are higher than the targets set in 2007 but still in line with its reported 2009 savings. The targets increase sharply from 2012 to 2015, then decline through 2020. The targets are much higher than the estimated market savings potential throughout the forecast period. The cumulative total of the program savings targets from 2011 through 2020 are equivalent to 10.7 percent of forecasted electricity use for 2020.

### Key Analytical Differences From Other Utilities

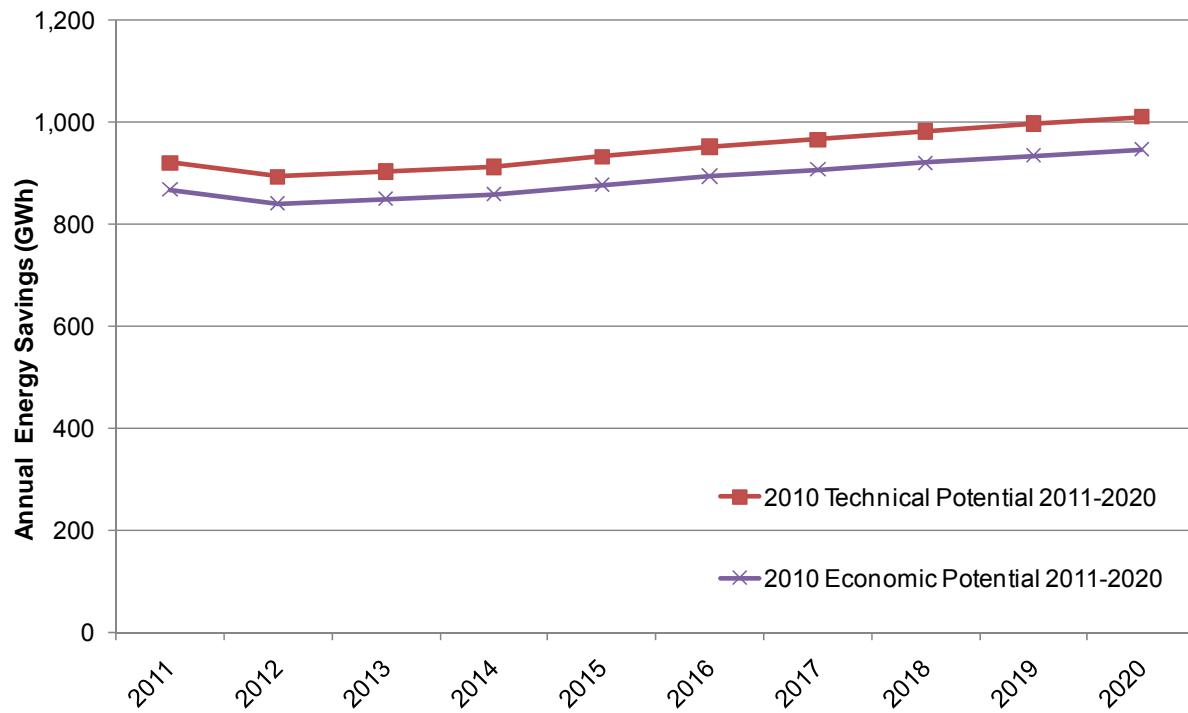
Anaheim's CalEERAM model had few obvious differences from the other 11 POUs. It was the only 1 of the 12 to analyze lodging as one of its commercial building types. It explicitly excluded only one measure in its analysis, compact fluorescent lighting (CFL) screw-in lamps (14-26 watts) for miscellaneous building. No measures were explicitly included.

The market savings potential in Anaheim's October model were 35 percent lower than those in CMUA's 2010 report. Without a copy of the model used to estimate the published market savings potentials and targets, KEMA cannot fully explain Anaheim's results.

### Technical and Economic Savings Potential

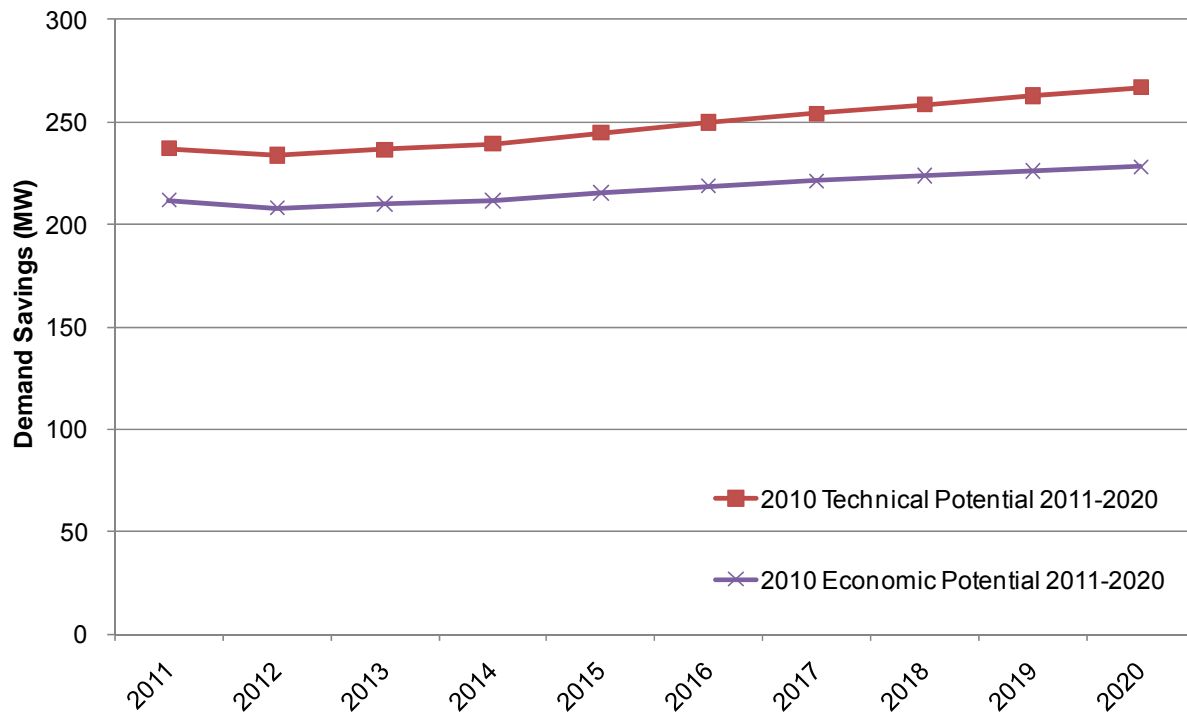
**Figure 29** (energy) and **Figure 30** (demand) show Anaheim's technical and economic savings potential, as developed in its revised October 2010 CalEERAM model. Savings dip slightly in 2012 as a result of the implementation of new federal lighting standards that improve the efficiency of baseline lighting and reduce the savings potential for CFLs. Savings estimates then climb through the end of the forecast period, averaging 1.6 percent growth per year.

**Figure 29: Technical and Economical Energy Savings Potential (MWh)—Anaheim**



Source: Data obtained from California Energy Efficiency Resource Assessment Model (October 2010).

**Figure 30: Technical and Economic Demand Savings Potential (MW)—Anaheim**

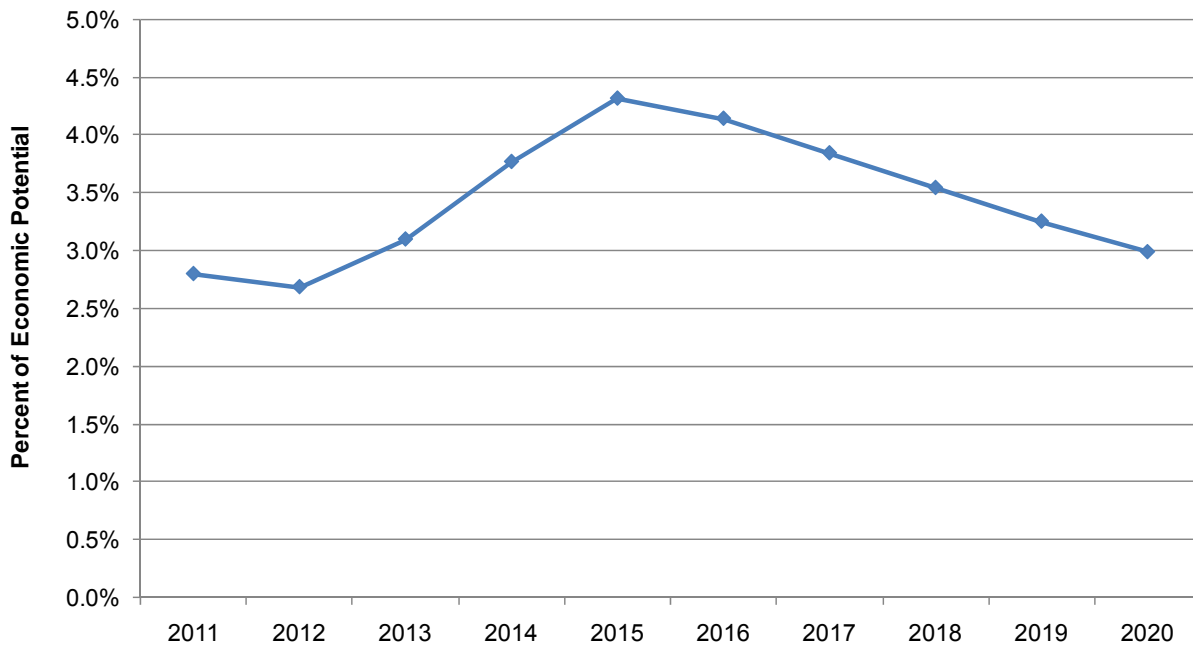


Source: Data obtained from California Energy Efficiency Resource Assessment Model (October 2010).

### Market Savings Potential and Targets

**Figure 31** shows Anaheim’s energy savings targets as a percentage of economic savings potential. Of the POUs studied, Anaheim’s targets have the steepest rate of increase over any period, with annualized growth of almost 19 percent between 2012 and 2015.

**Figure 31: Target Energy Savings as a Percentage of Economic Savings Potential—Anaheim**

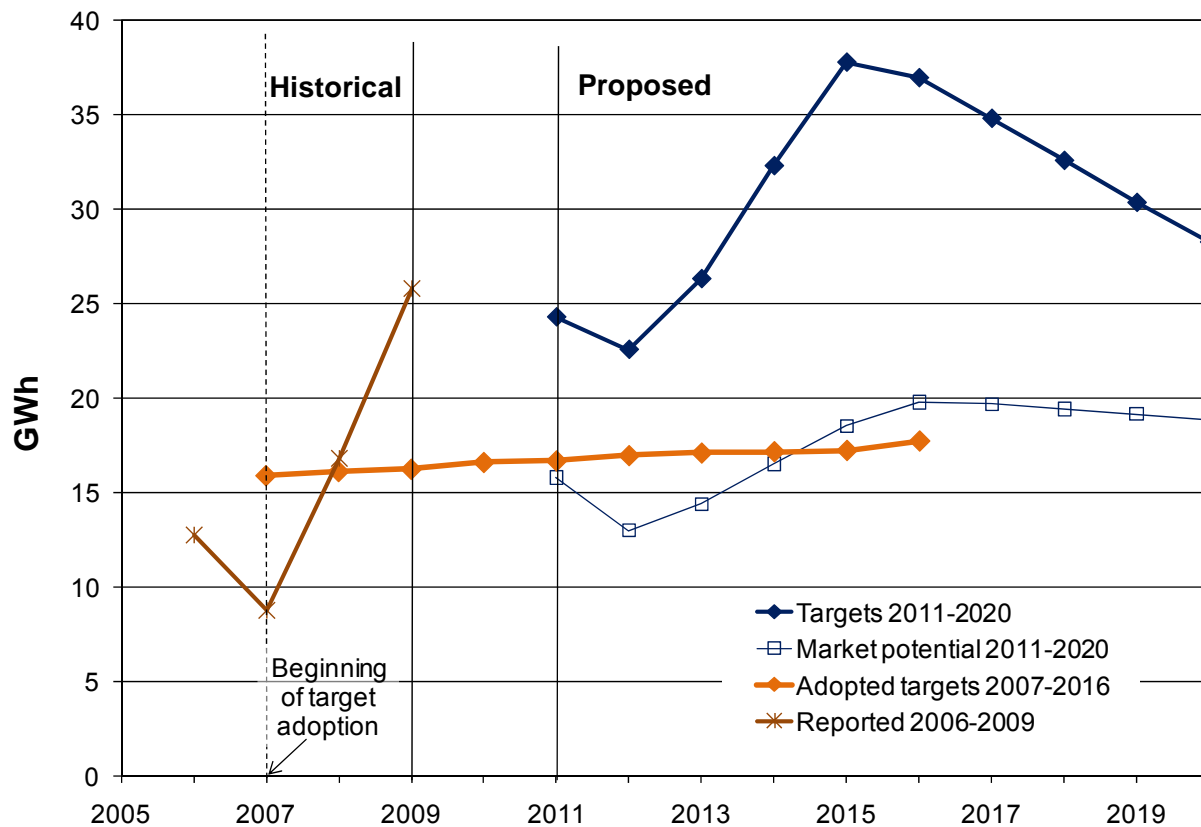


Source: Data obtained from California Municipal Utilities Association, *Energy Efficiency in California's Public Power Sector. A Status Report*, March 2010, combined with California Energy Efficiency Resource Assessment Models (October 2010).

**Figure 32** shows Anaheim's new targets for 2011 to 2020 as compared with previous targets, past program savings, and recent estimates of market savings potential. Anaheim's new targets are notably higher than old targets, even in 2011 (although consistent with 2009 savings), and climb sharply from 2012 to 2015. By 2015, the targets are more than twice as high as the previous targets for that year.

The ramp-up rate in Anaheim's targets is quite steep compared with other utilities, with an annualized growth of almost 19 percent between 2012 and 2015. (See **Figure 25** and its accompanying discussion.)

**Figure 32: Anaheim's Historical Annual Energy Efficiency Program Savings and Targets**



Source: Data for 2011-2020 targets obtained from California Municipal Utilities Association, *Energy Efficiency in California's Public Power Sector. A Status Report*, March 2010. Data for 2011-2020 market potential obtained from California Energy Efficiency Resource Assessment Models (October 2010). Data for 2009 reported savings obtained from California Municipal Utilities Association, *Energy Efficiency in California's Public Power Sector. A Status Report*, March 2009. Data for 2007-2016 targets obtained from California Municipal Utilities Association, *Establishing Energy Efficiency Targets: A Public Power Response to AB2021. Final Update*, October 2007.

Anaheim's 2011-2020 targets are uniformly higher than its market savings potential.<sup>34</sup> Although 2009 savings suggest that the targets may be achievable, at least in the early years, the market savings potential estimates suggest that the level of savings may not be sustainable over time.

Behavior in the residential sector drives the decline in market savings potential after 2015. Customer awareness for most residential measures reaches 100 percent by 2016 so without increasing awareness, there is a decline in potential new participants that drives the savings downward. In other words, the more customers who adopt high-efficiency measures, the smaller the pool of potential participants.

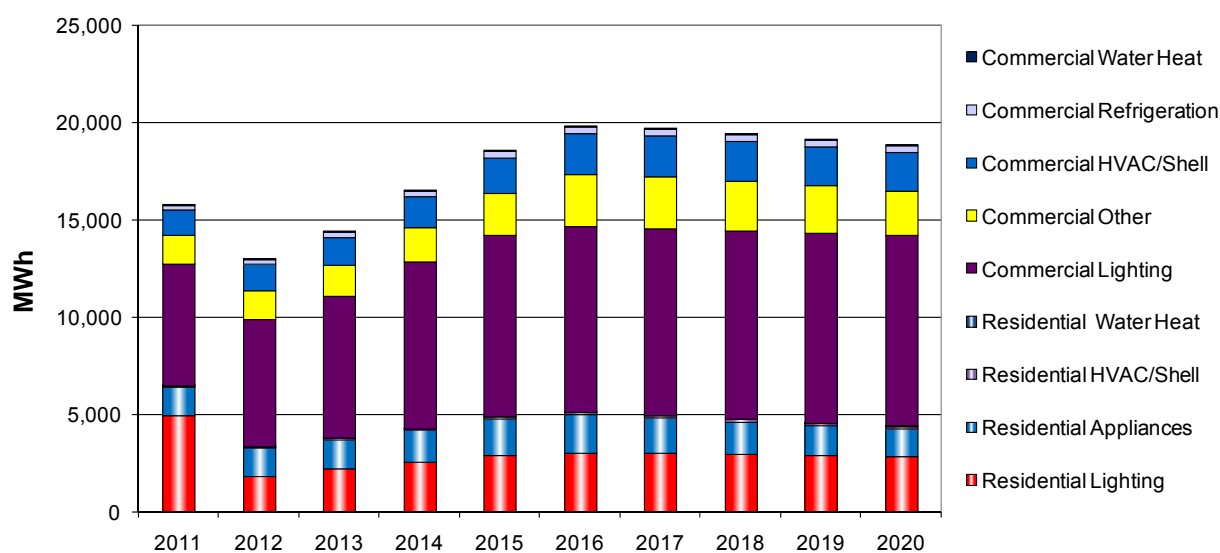
<sup>34</sup> For the March 2010 CMUA report, Anaheim's targets were the same as its market savings potential. The October revision to the model produced market savings potentials that were much lower than the March report. (See Figure 4 and its accompanying discussion.)

After failing to meet its 2007 targets, Anaheim met or nearly met its targets in 2008 and 2009. This success indicates that Anaheim can probably meet its 2011 to 2013 targets with its current programs, but reaching targets in 2014 and beyond may require substantial additional effort.

### Market Savings Potential by End Use

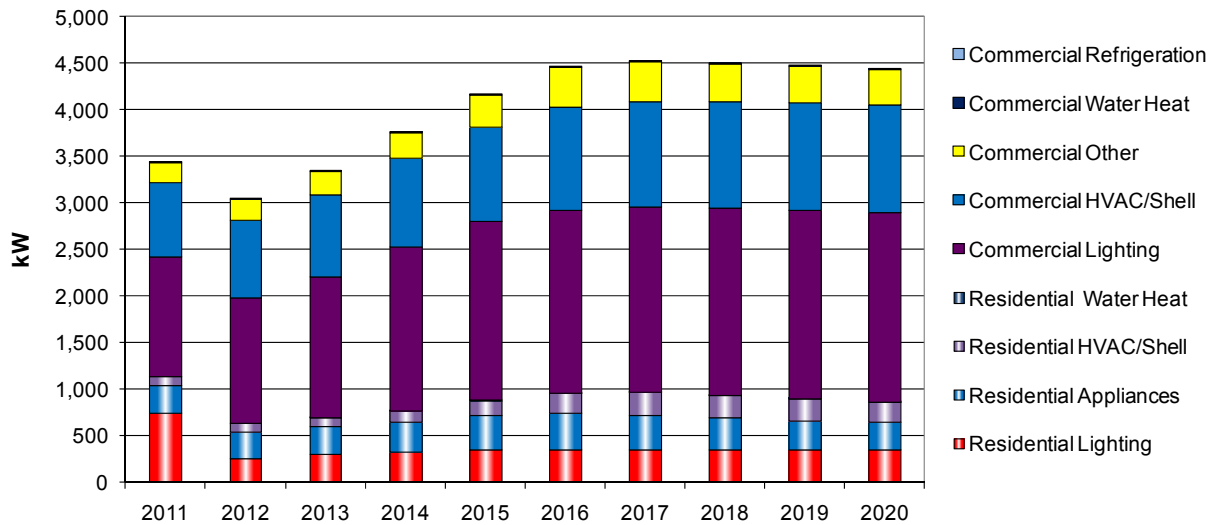
KEMA used revised 2010 CalEERAM data to break up market savings potential to show opportunities for specific programs by both customer sector and end use category. **Figure 33** and **Figure 34** show market energy and peak demand savings potential, respectively, by sector and end use. Commercial lighting is the largest contributor to market energy savings potential. Residential lighting, residential appliances, commercial heating, ventilation, and air conditioning (HVAC), commercial building shell, and commercial “other” also contribute significantly to energy savings, although their relative importance varies over the forecast period. Commercial lighting and commercial HVAC are the most significant contributors to market peak demand savings potential.

**Figure 33: Anaheim’s Market Savings Potential (MWh) by End Use**



Source: Data obtained from California Energy Efficiency Resource Assessment Model (October 2010).

**Figure 34: Anaheim's Market Savings Potential (kW) by End Use**



Source: Data obtained from California Energy Efficiency Resource Assessment Model (October 2010).

### Program Factors Affecting Target Feasibility and Reliability

Anaheim plans its efficiency programs one year ahead. Budget setting is an annual process, and the Anaheim City Council approves each year's budgets. Anaheim's budget does not receive any money from the city's general fund. The energy efficiency programs are self-funded, and Anaheim does not collect a public benefit charge from its customers.

Anaheim has eight people working on energy efficiency projects, including two part-time staffers. The utility has a manager for each of the following areas: solar, residential, business, and research, development, and demonstration. Anaheim contracts out some residential program work to a third-party provider, which also handles Anaheim's Dusk to Dawn program. Another contractor manages Anaheim's low-income programs.

Anaheim program staff states that program year 2009/2010 was a good year for efficiency programs. Net savings were about 36,000 MWh. Savings came both from some large commercial projects and from CFLs. Staff reports that projected savings for 2011 are down by about 12,000 MWh.

Anaheim plans to meet its higher targets by doing more commercial energy efficiency projects.

So far, Anaheim has not seen any measure saturation, even in CFLs. Anaheim staff indicated that it would like to do more marketing in the residential sector for CFLs and still feels that lighting gives "the biggest bang for your buck."

Anaheim staff is searching for a new EM&V contractor, since it was dissatisfied with its previous contractor's work.

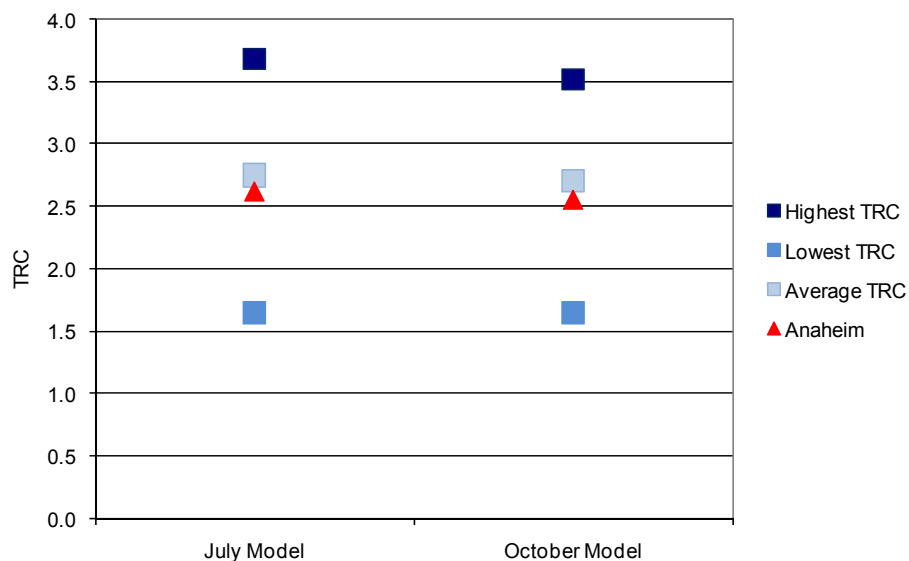
## Program Cost-Effectiveness

Anaheim's fiscal year 2008/2009 programs had a TRC ratio of 7.63 (CMUA 2010, Table 7).

Neither available version of the CalEERAM model matches the savings potentials presented in the CMUA March 2010 report, so the cost-effectiveness of the targets is not available. The July version of the CalEERAM model shows a TRC ratio of 2.62 for the estimated market savings potential, and the October revised version of the model shows a TRC ratio of 2.55. **Figure 35** shows the two TRCs for Anaheim compared with the range of TRC ratios reported by other utilities. Anaheim's TRC ratio is slightly lower than average.

The cost per first-year kWh savings from Anaheim's model was 61 cents for the residential sector and 33 cents for nonresidential in 2015, compared with an average of 58 cents for residential and 36 cents for nonresidential across all of the POU models. Anaheim's cost is close to average for residential and a bit below average for nonresidential. Again, to meet its targets, Anaheim's program would have to be more aggressive than what it modeled, which would tend to increase the cost per kWh.

**Figure 35: Anaheim's TRCs From Two CalEERAM Versions, Compared to Other POU**

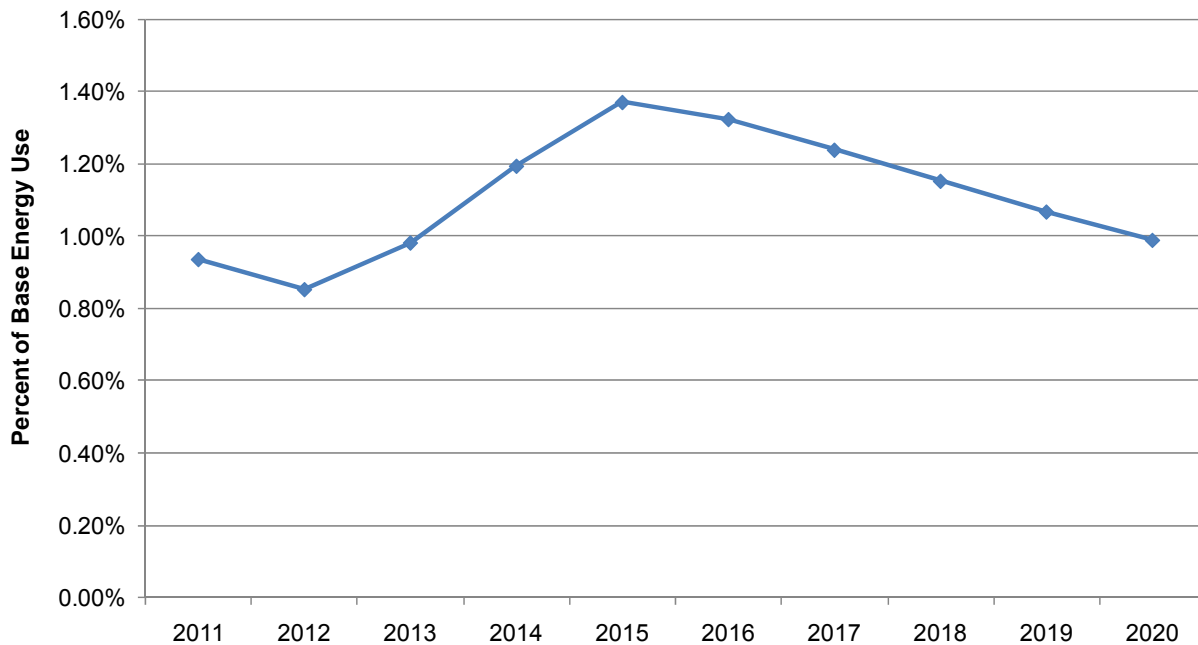


Source: Data obtained from California Energy Efficiency Resource Assessment Model (October 2010) and (July 2010) versions.

## Targets' Contribution to Energy Use Reduction

**Figure 36** shows target energy savings as a percentage of total energy use. Savings range from a low of 0.85 percent in 2012 to a high of 1.37 percent in 2015. Savings climb steeply from 2012 to 2015, and then decline through the end of the forecast. Cumulatively, the targets add up to 10.7 percent of forecasted energy use for the year 2020 (based on the energy use forecast in the CalEERAM model), which exceeds the 10 percent reduction goal of AB 2021.

**Figure 36: Target Energy Savings as a Percentage of Base Energy Use—Anaheim**



Source: Data obtained from California Municipal Utilities Association, *Energy Efficiency in California's Public Power Sector. A Status Report*, March 2010.

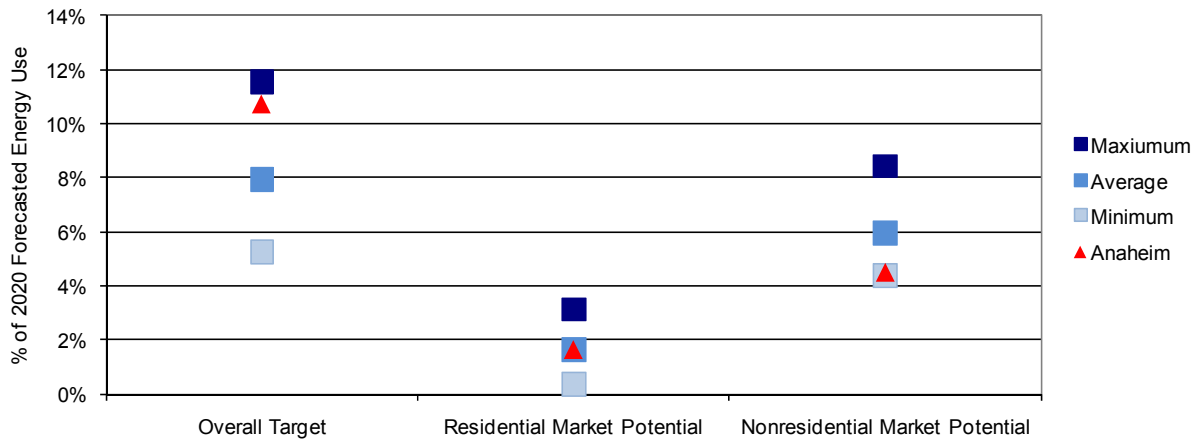
### Assessment of Targets

In this section, KEMA evaluates Anaheim's targets first by comparing them with those of the other 11 POUs, then evaluating whether they adequately meet AB 2021's reduction requirement (cost-effectiveness, feasibility, reliability, and energy use reduction).

**Figure 37** shows the sum of Anaheim's 2011-2020 targets as a percentage of energy use, relative to those of other POUs. The overall target is from the March 2010 CMUA report and represents Anaheim's current commitments. Because the CMUA report did not break out targets by sector, **Figure 37** shows the sector breakdowns of market savings potentials from the October 2010 CalEERAM revision.

Anaheim's target is among the highest of the 12 utilities in the detailed study. Anaheim's residential market savings potential is close to average, and its nonresidential savings potential is close to the minimum. This discrepancy between the targets and market savings potential appears in the model version provided to the Energy Commission in July and did not agree with the savings potentials in the CMUA March 2010 report.

**Figure 37: Anaheim's Targets in Context of 12 of the Largest POUs**



Source: Data obtained from California Municipal Utilities Association, *Energy Efficiency in California's Public Power Sector. A Status Report*, March 2010, combined with California Energy Efficiency Resource Assessment Models (October 2010).

### Summary of Target Adequacy

In this section KEMA examines the adopted targets across all four AB 2021 target assessment criteria. **Table 17** summarizes the findings. Anaheim's targets did not meet either feasibility or reliability requirements. The feasibility of Anaheim's targets is questionable because the targets are much higher than the estimated market savings potential. While this finding raises concern, Anaheim's actual 2009 savings exceeded its 2011 market savings potential, indicating that the targets may not be as much of a stretch as the market savings potential suggests. In the area of reliability, Anaheim has not completed EM&V on its programs, although it did develop an EM&V plan in 2010.

**Table 17: Target Assessment—Anaheim**

<b>Target Criterion</b>	<b>Criteria Description</b>	<b>How well does it meet this criterion?</b>
Cost-Effectiveness	TRC ratio $\geq 1$	TRC ratio = 2.62
Feasibility	<ul style="list-style-type: none"> <li>Revised targets are reasonably related to reported savings (2006-2009)?</li> <li>Revised targets are reasonably related to market savings potential?</li> <li>Annual ramp-up rate in future years is reasonable?</li> <li>Budget and staffing is likely to be in place to achieve targets?</li> </ul>	<p>Targets are in line with 2008-2009 reported savings.</p> <p>Targets are significantly higher than estimated market savings potential.</p> <p>Ramp-up 2012-2015 is aggressive but achievable with appropriate budget and staffing.</p> <p>Meeting targets will probably require additional budget and staffing.</p>
Reliability	<ul style="list-style-type: none"> <li>Successfully achieved 2007 targets in most years?</li> <li>Utility performs regular EM&amp;V?</li> </ul>	<p>Anaheim more than doubled its savings from 2006-2009, and met its 2008 and 2009 targets.</p> <p>Anaheim is performing EM&amp;V on its programs.</p>
Energy Use Reduction	<ul style="list-style-type: none"> <li>Meets 10% reduction over 10 years?</li> </ul>	Current targets reach 10.7% of 2020 forecasted use over 10 years

### Options for Increasing Efficiency

Anaheim's targets already meet AB 2021's goal of 10 percent reduction of base use over 10 years. However, the programs modeled in the July and October version of Anaheim's CalEERAM model do not show how the utility can meet that goal.

KEMA altered the inputs to Anaheim's model to see what changes would be required for the market savings potential to meet the AB 2021 requirement for 10-year energy use reduction. KEMA applied the TRC ratio  $\geq 1$  cost-effectiveness rule to all measures to determine whether the analysis would include them. KEMA then increased Anaheim's incentive levels incrementally until market savings potential achieved 10 percent over 10 years.

Setting incentives at 70 percent of incremental measure cost produced a cumulative savings over 10 years of 10 percent of use; the overall TRC ratio was 2.52, and the 2011 cost was 37 cents per first-year kWh savings, which increased to 71 cents per kWh by 2020. For comparison, Anaheim's existing program has an overall TRC ratio of 7.63 and cost about 17 cents per kWh in fiscal year 2008/2009.<sup>35</sup>

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<sup>35</sup> Calculated from program data in CMUA (2010), Table 7.

## Burbank

### Summary of Revised Targets

Efficiency savings for Burbank Water and Power (Burbank) in fiscal year 2008/2009 represented 1.3 percent of all POU (including SMUD and LADWP) energy efficiency savings (CMUA 2010). Burbank's 2007 targets represented a significant increase over its 2006 program savings. Burbank did not meet its targets in 2007, 2008, and 2009. Burbank's new targets for 2011 and 2012 are lower than the targets set in 2007 but in line with the savings reported for 2008 and 2009. The targets increase moderately from 2012 to 2016, then decline through 2020. The targets are slightly higher than the estimated market savings potential throughout the forecast period, with the gap widening over time. The cumulative total of the program savings targets from 2011 to 2020 are equivalent to 7.5 percent of forecasted electricity use for 2020.

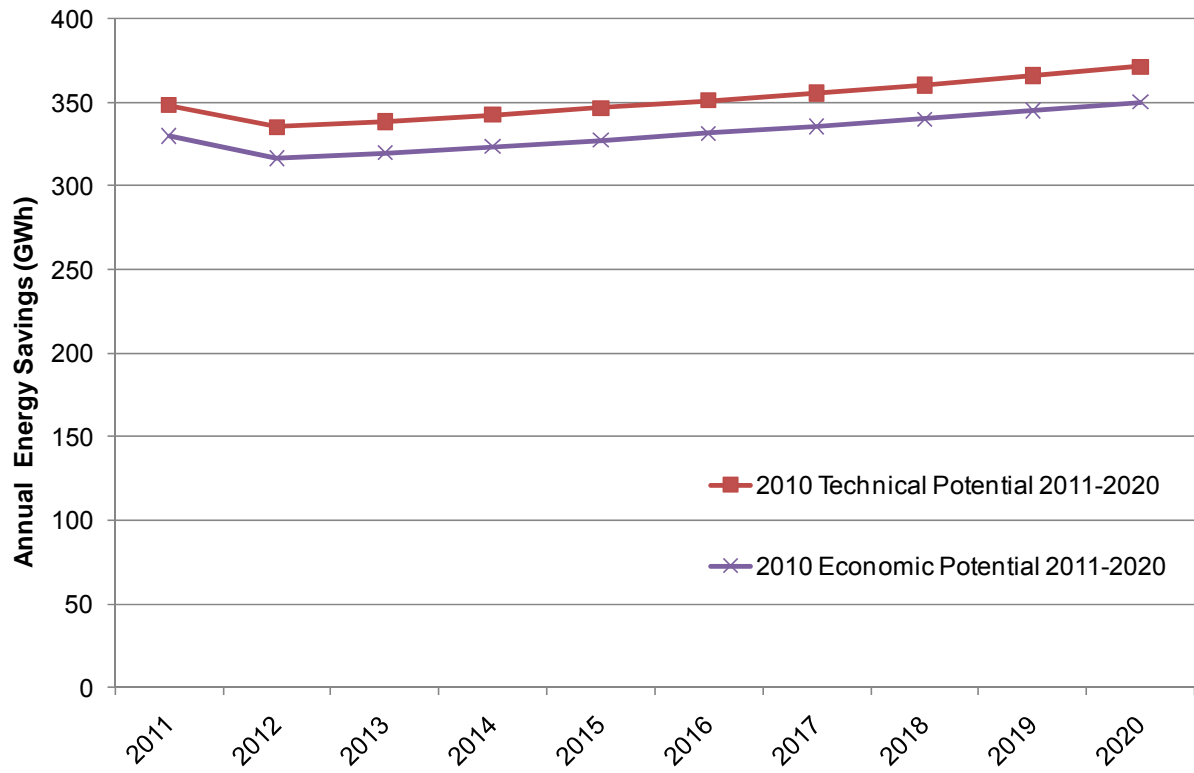
### Key Analytical Differences From Other Utilities

Burbank's CalEERAM model did not have any major, obvious differences from most of the other POUs.

### Technical and Economic Savings Potential

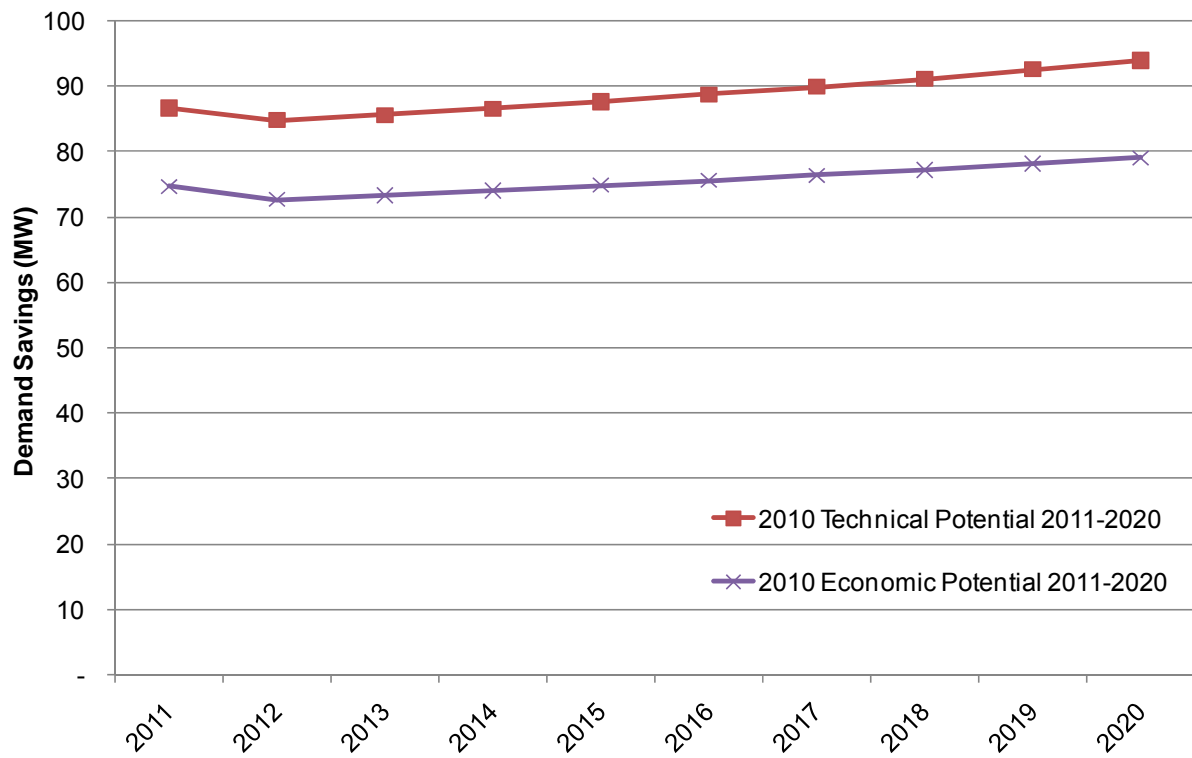
**Figure 38** (energy) and **Figure 39** (demand) show Burbank's technical and economic savings potential, as developed in its revised CalEERAM model from October 2010. Savings dip slightly in 2012 due to the new federal lighting standard, which will improve the efficiency of baseline lighting and reduce the savings potential for CFLs. Savings then begin climbing through the end of the forecast, averaging 1.3 percent growth per year.

**Figure 38: Technical and Economical Energy Savings Potential (MWh)—Burbank**



Source: Data obtained from California Energy Efficiency Resource Assessment Model (October 2010).

**Figure 39: Technical and Economic Demand Savings Potential (MW)—Burbank**

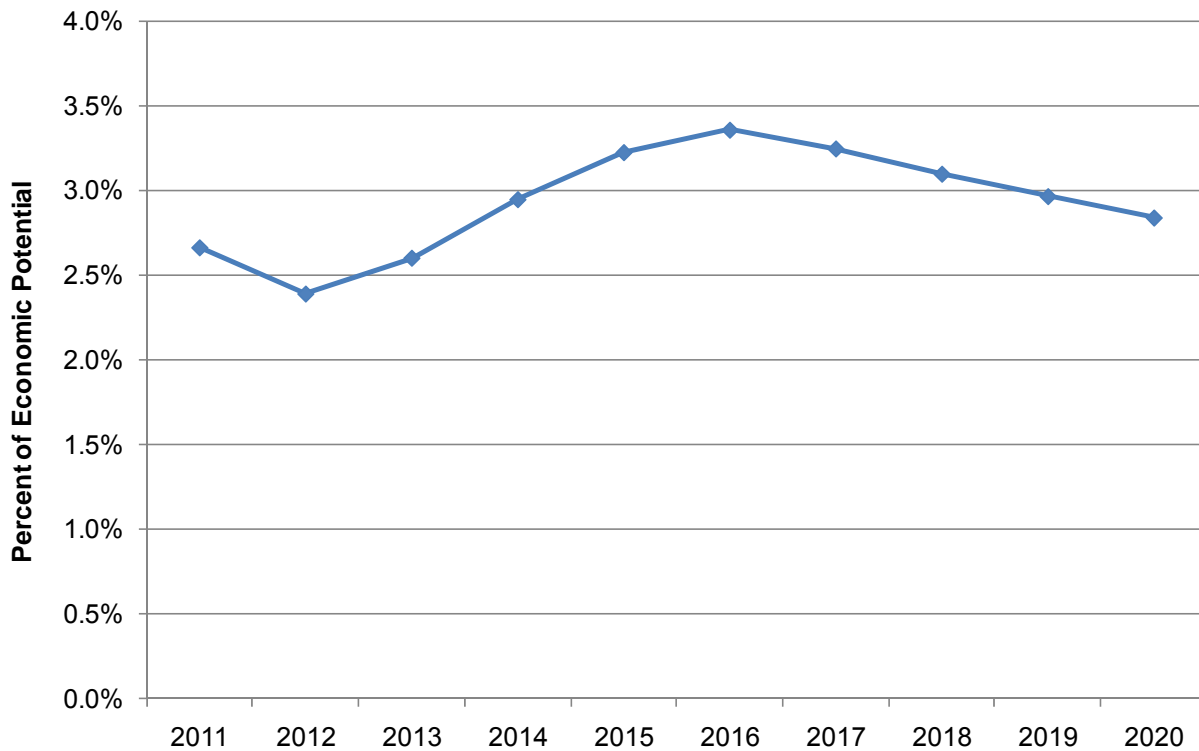


Source: Data obtained from California Energy Efficiency Resource Assessment Model (October 2010).

### Market Savings Potential and Targets

**Figure 40** shows Burbank's energy savings targets as a percentage of economic savings potential.

**Figure 40: Target Energy Savings as a Percentage of Economic Savings Potential—Burbank**



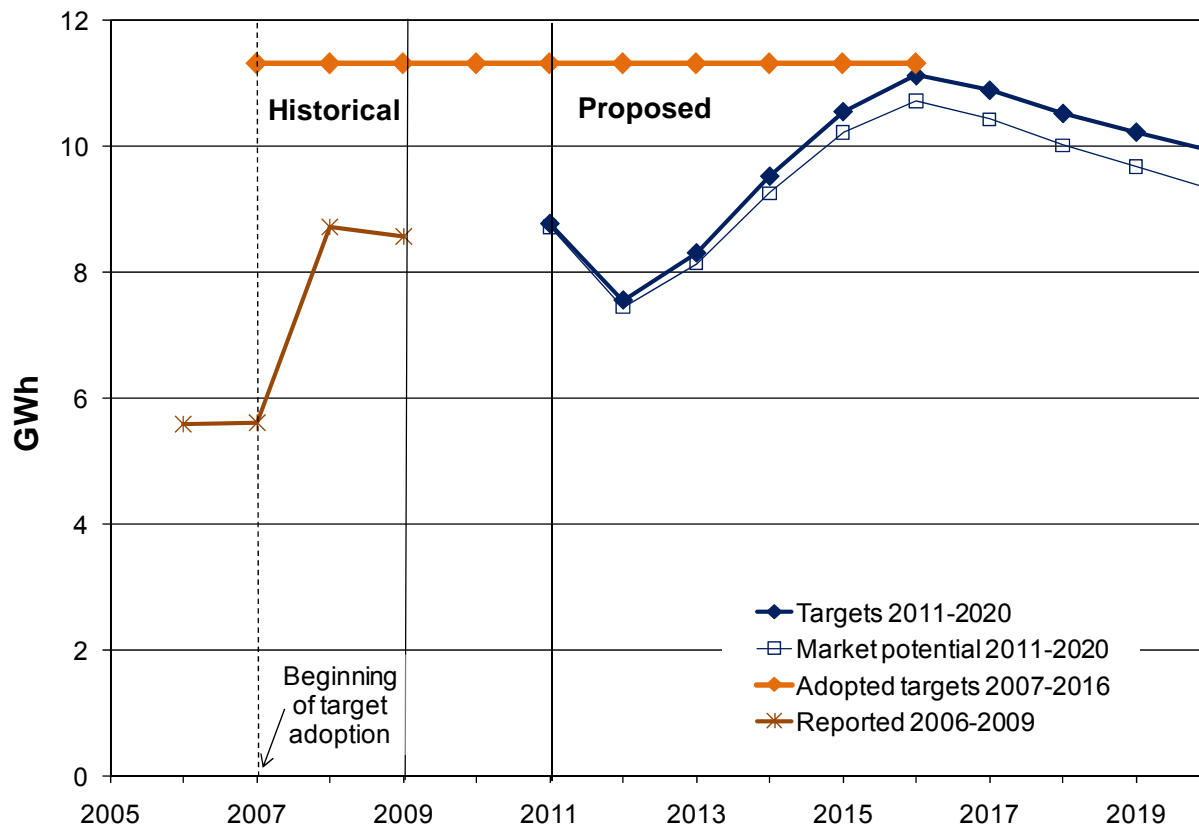
Source: Data obtained from California Municipal Utilities Association, *Energy Efficiency in California's Public Power Sector. A Status Report*, March 2010, combined with California Energy Efficiency Resource Assessment Models (October 2010).

**Figure 41** shows Burbank's new targets for 2011 to 2020, as compared with previous targets, past program savings, and recent estimates of market savings potential. From 2011 to 2015, Burbank's new targets are lower than its older targets. The 2016 target is close to the target set in 2007. The revised targets vary over time as opposed to the 2007 targets, which were flat over the forecast period.

Looking at Burbank's historical savings, Burbank did not meet its targets in 2007 through 2009. The revised targets represent a level of savings more in line with past accomplishments. The revised target for 2011 is consistent with 2008 and 2009 reported savings. The target then dips in 2012 (due to the effect of new federal lighting standards) and does not climb back to those savings levels until 2014.

The ramp-up in Burbank's targets is modest and in line with many of the other utilities, with an annualized increase of about 9 percent per year between 2011 and 2016. (See **Figure 25** and its accompanying discussion.)

**Figure 41: Burbank's Historical Annual Energy Efficiency Program Savings and Targets**



Source: Data for 2011-2020 targets obtained from California Municipal Utilities Association, *Energy Efficiency in California's Public Power Sector. A Status Report*, March 2010. Data for 2011-2020 market potential obtained from California Energy Efficiency Resource Assessment Models (October 2010). Data for 2009 reported savings obtained from California Municipal Utilities Association, *Energy Efficiency in California's Public Power Sector. A Status Report*, March 2009. Data for 2007-2016 targets obtained from California Municipal Utilities Association, *Establishing Energy Efficiency Targets: A Public Power Response to AB2021. Final Update*, October 2007.

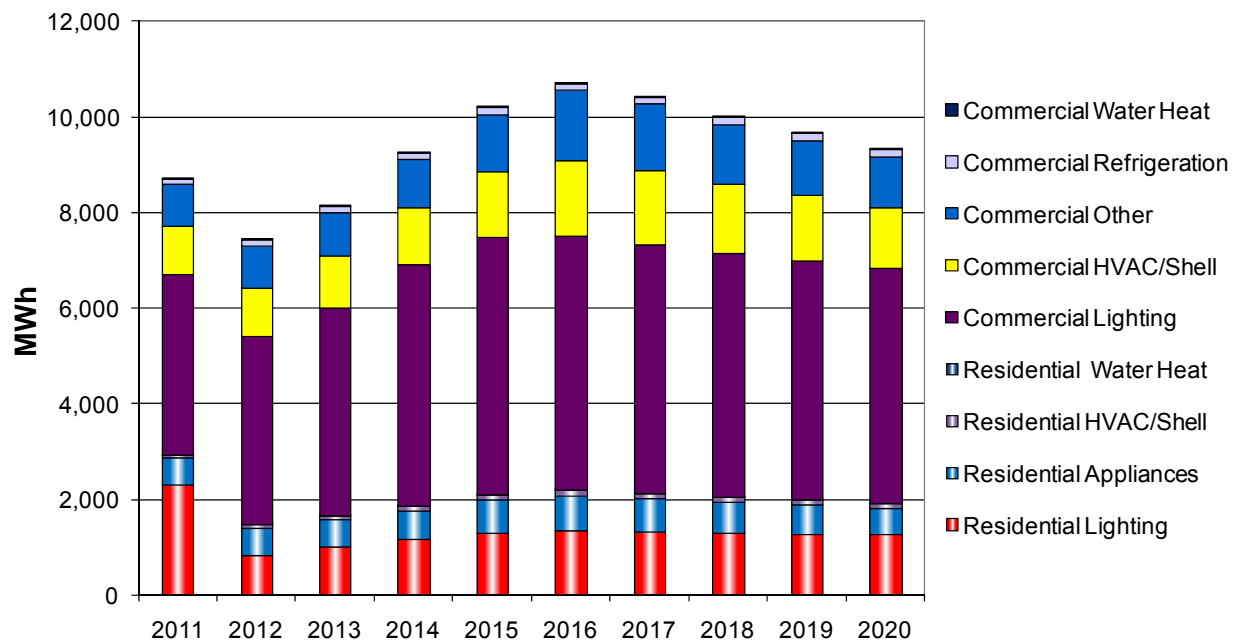
Burbank's 2011-2020 targets differ only slightly from their estimated market savings potential, with targets slightly higher than market savings potentials. Given the margin of error in the potential estimate, KEMA does not believe that this gap will affect Burbank's ability to meet its targets, especially in the early years of the forecast period.

The decline in market savings potential after 2016 reflects declines in both residential and nonresidential market savings potential. Awareness for most measures reaches 100 percent by 2016; without increasing awareness, the decline in potential participants drives savings. In other words, the more customers who adopt high-efficiency measures, the smaller the pool of potential participants.

## Market Savings Potential by End Use

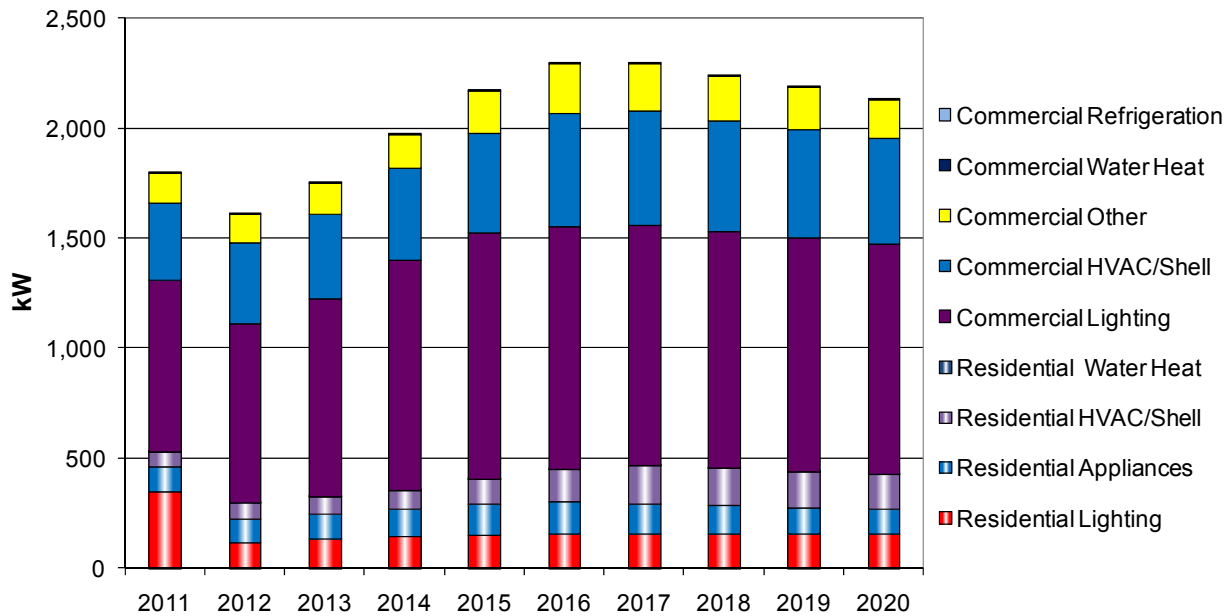
KEMA used revised 2010 CalEERAM data to disaggregate market savings potential to show opportunities for specific programs by both customer sector and end-use category. **Figure 42** and **Figure 43** show market energy and peak demand savings potential, respectively, by sector and end use. Commercial lighting is the largest contributor to market energy savings potential. Residential lighting, residential appliances, commercial HVAC/shell, and commercial “other” also contribute significantly to energy savings. Commercial lighting and commercial HVAC are the most significant contributors to market peak demand savings potential.

**Figure 42: Burbank’s Market Savings Potential (MWh) by End Use**



Source: Data obtained from California Energy Efficiency Resource Assessment Model (October 2010).

**Figure 43: Burbank's Market Savings Potential (kW) by End Use**



Source: Data obtained from California Energy Efficiency Resource Assessment Model (October 2010).

### Program Factors Affecting Target Feasibility and Reliability

Burbank can only meet its targets with both a realistic vision and a credible implementation plan. The utility designs programs on a multiyear cycle. Budgets, however, are funded annually.

Burbank is increasing staffing in its efficiency division this year by adding one position.

Changes to Burbank's programs include the addition of home energy reports and another informational program, both this year. Burbank is also installing smart meters this year. In its existing programs, Burbank expects that its Business Bucks program (which includes energy audits and retrofit incentives for small and medium businesses) will continue to slow as more businesses participate and the eligible pool shrinks.

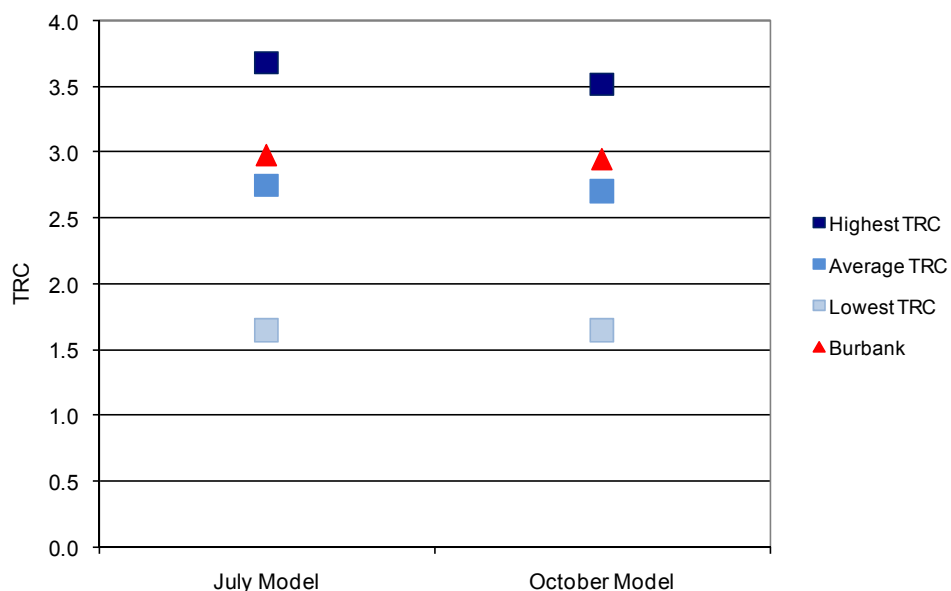
Burbank identified the slow economy as the greatest barrier to achieving savings. Customers are less willing to contribute to the cost of efficiency measures.

### Program Cost-Effectiveness

Burbank's fiscal year 2008/2009 programs had a TRC ratio of 3.95 (CMUA 2010, Table 7). The CalEERAM model used to set the targets has a TRC ratio of 2.98. The error in the version of the model used to create this value increases uncertainty in the TRC ratio estimate, so reviewers also looked at the TRC ratio associated with the market savings potential from the revised CalEERAM, which is 2.95. **Figure 44** shows the two TRC ratios for Burbank, compared with the other utilities. Burbank's TRC ratio is slightly higher than average.

The cost per first-year kWh of savings from Burbank’s model was 61 cents for residential and 30 cents for nonresidential in 2015, compared to an average of 58 cents for residential and 36 cents for nonresidential across the POU models studied. Burbank’s residential cost is close to average for residential and below average for nonresidential.

**Figure 44: Burbank’s TRC Ratios From Two CalEERAM Versions, Compared to Other POUs**

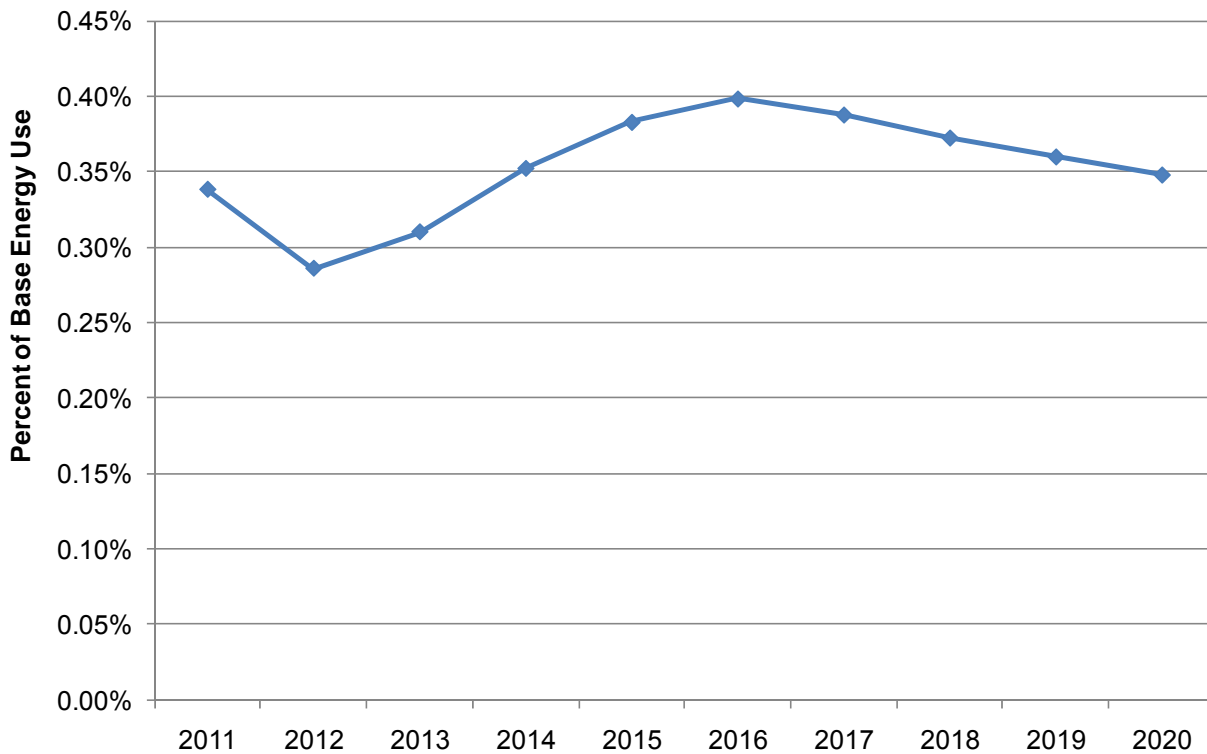


Source: Data obtained from California Energy Efficiency Resource Assessment Model (October 2010) and (July 2010) versions.

### Targets’ Contribution to Energy Use Reduction

Successfully meeting its targets will reduce Burbank’s electricity use over the forecast period. **Figure 45** shows target energy savings as a percentage of total energy use. Savings climb from 2012 to 2016, then decline through the end of the forecast. Cumulatively, the targets add up to 7.5 percent of forecasted energy use for 2020 (based on the energy use forecast in the CalEERAM model), which do not meet the AB 2021 10 percent reduction requirement.

**Figure 45: Target Energy Savings as a Percentage of Base Energy Use—Burbank**



Source: Data obtained from California Municipal Utilities Association, *Energy Efficiency in California's Public Power Sector. A Status Report*, March 2010.

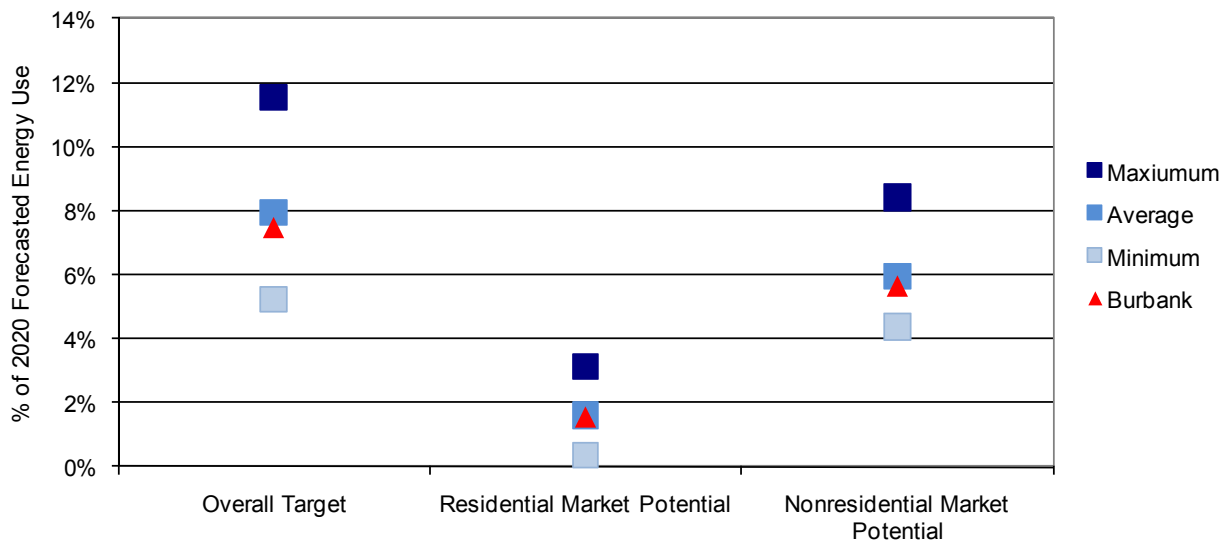
### Assessment of Targets

In this section, KEMA evaluates Burbank's targets by first comparing them with the other 11 POUs, then evaluating whether they adequately meet AB 2021 requirements (cost-effectiveness, feasibility, reliability, and energy use reduction).

**Figure 46** shows the sum of Burbank's 2011-2020 targets as a percentage of energy use, relative to those of other POUs. Burbank calculated the overall target from the March 2010 CMUA report, and the target represents Burbank's current commitments. Because the CMUA Report did not break out targets by sector, **Figure 46** shows the sector breakdowns of market savings potentials from the October 2010 CalEERAM revision.

Overall, Burbank's target is slightly below average. Burbank's residential market savings potential is close to average, and its nonresidential savings potential is slightly below average.

**Figure 46: Burbank's 10-Year Cumulative Targets, Compared to the Other POUs**



Source: Data obtained from California Municipal Utilities Association, *Energy Efficiency in California's Public Power Sector. A Status Report*, March 2010.

### *Summary of Target Adequacy*

In this section KEMA examines the targets adopted across all four AB 2021 target assessment criteria. **Table 18** summarizes the findings. Burbank's targets did not meet either the feasibility or cost-effectiveness targets. Burbank similarly did not meet its 2007 through 2009 targets but may more easily meet its lower revised 2010 targets. While these targets may be easier for Burbank to meet, they still fall short of the AB 2021 10-year, 10 percent reduction requirement.

**Table 18: Target Assessment—Burbank**

Target Criterion	Criteria Description	How Well Does It Meet This Criterion?
Cost-Effectiveness	TRC ratio $\geq 1$	TRC ratio = 2.95
Feasibility	<ul style="list-style-type: none"> <li>Revised targets are reasonably related to reported savings (2006-2009)?</li> <li>Revised targets are reasonably related to market savings potential?</li> <li>Annual ramp-up rate in future years is reasonable?</li> <li>Budget and staffing is likely to be in place to achieve targets?</li> </ul>	<p>Targets are in line with 2008-2009 reported savings.</p> <p>Targets are close to estimated market savings potential.</p> <p>Ramp-up 2012-2016 is moderate and achievable with appropriate budget and staffing.</p> <p>Additional budget and staffing may be required to meet targets.</p>
Reliability	<ul style="list-style-type: none"> <li>Successfully achieved 2007 targets in most years?</li> <li>Utility performs regular EM&amp;V?</li> </ul>	<p>Burbank failed to meet its 2008 and 2009 targets.</p> <p>Burbank completed an EM&amp;V study of its 2009 programs.</p>
Energy Use Reduction	<ul style="list-style-type: none"> <li>Meets 10% reduction over 10 years?</li> </ul>	Current targets reach 7.5% of 2010 forecasted use over 10 years

### Options for Increasing Efficiency

KEMA altered the inputs to Burbank's model to see what changes would be required for the market savings potential to meet the AB 2021 10-year energy use reduction requirement. KEMA increased Burbank's incentive levels incrementally until market savings potential achieved 10 percent over 10 years. Setting incentives at 66 percent of incremental measure cost produced 10 percent cumulative savings over 10 years, with an overall TRC ratio of 2.85 and a 2011 cost of 33 cents per first-year kWh (increasing to 65 cents per kWh by 2020). By comparison, Burbank's existing program has an overall TRC ratio of 3.95 and costs about 39 cents per kWh in fiscal year 2008/2009.<sup>36</sup>

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<sup>36</sup> Calculated from program data in CMUA (2010), Table 7.

## Glendale

### Summary of Revised Targets

Efficiency savings for Glendale Water & Power (Glendale) in fiscal year 2008/2009 represented 1.8 percent of all POU (including SMUD and LADWP) energy efficiency savings (CMUA 2010). Glendale's 2007 targets represented a significant increase over its 2006 program savings. Although its savings fell short of its 2007 target, by 2008 and 2009 Glendale met its targets. Glendale's new targets for 2011 and 2012 are slightly lower than both the targets set in 2007, and the savings reported for 2008 and 2009. Glendale's targets are virtually flat over the forecast period, with only a slight increase, which is in line with an increase in overall energy use. The targets are much higher than the estimated market savings potential throughout the forecast period. The cumulative total of the program savings targets from 2011 to 2020 are equivalent to 9.8 percent of forecasted electricity use for 2020.

### Key Analytical Differences From Other Utilities

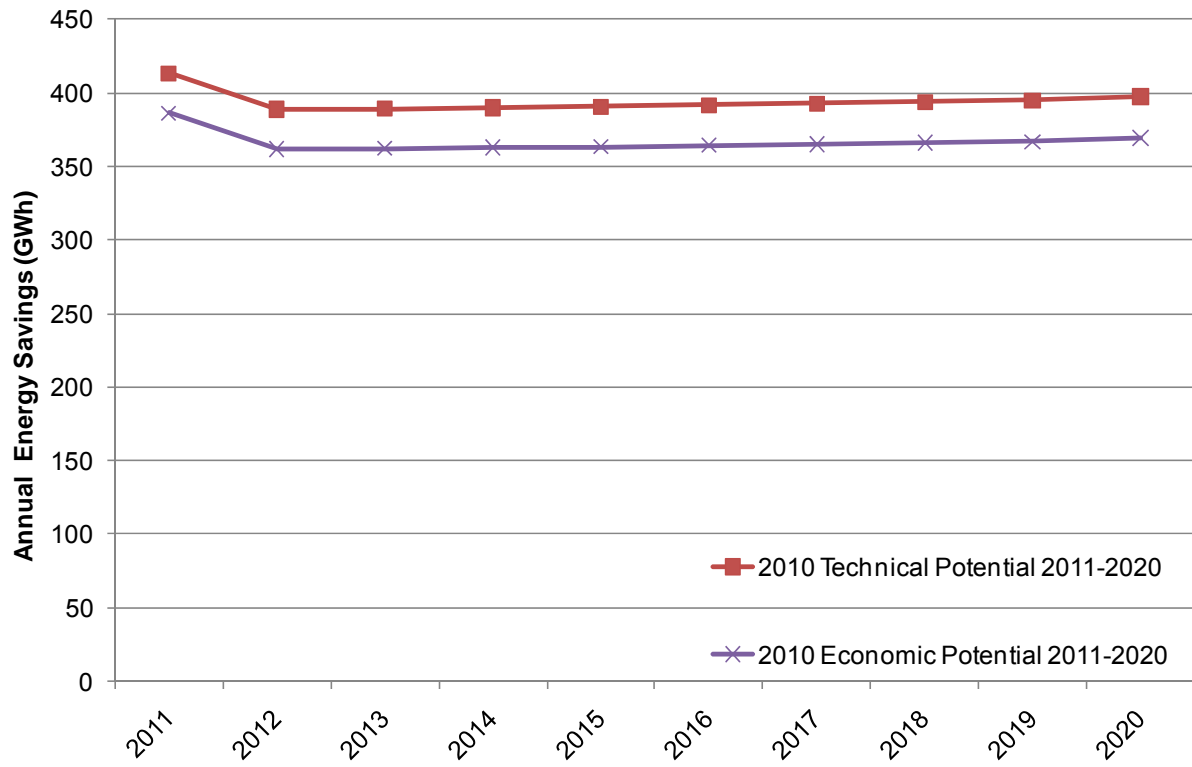
Glendale's rates are flat over the forecast period, while most other utilities' rates rise with the rate of inflation. Since the model is intended to accept nominal rates, Glendale's model effectively assumes declining real electricity rates.

Glendale was one of four utilities that set different targets from its market savings potential, instead setting virtually flat targets of 1 percent of system load each year.

### Technical and Economic Savings Potential

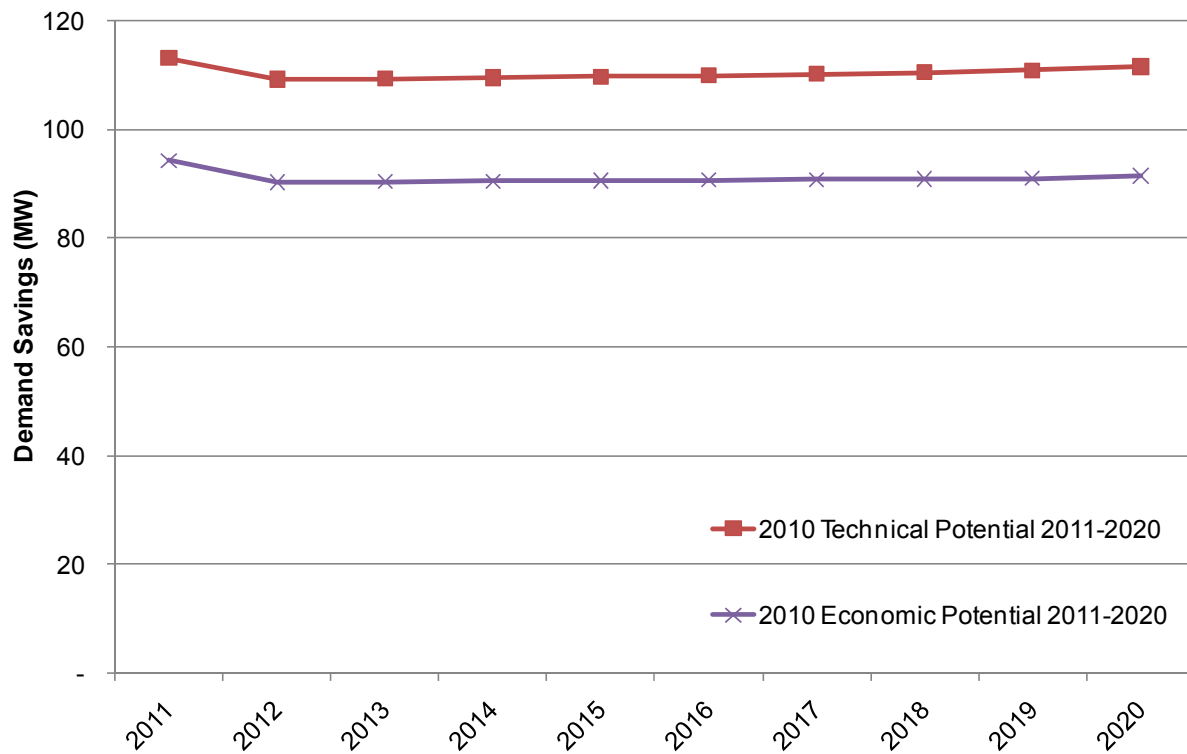
**Figure 47** (energy) and **Figure 48** (demand) show Glendale's technical and economic savings potential, as developed in its revised October 2010 CalEERAM model. Savings dip slightly in 2012 due to the new federal lighting standard, which will improve the efficiency of baseline lighting and reduce the savings potential for CFLs. Savings then begin slowly climbing through the end of the forecast, averaging 0.3 percent growth per year.

**Figure 47: Technical and Economical Energy Savings Potential (MWh)—Glendale**



Source: Data obtained from California Energy Efficiency Resource Assessment Model (October 2010).

**Figure 48: Technical and Economic Demand Savings Potential (MW)—Glendale**

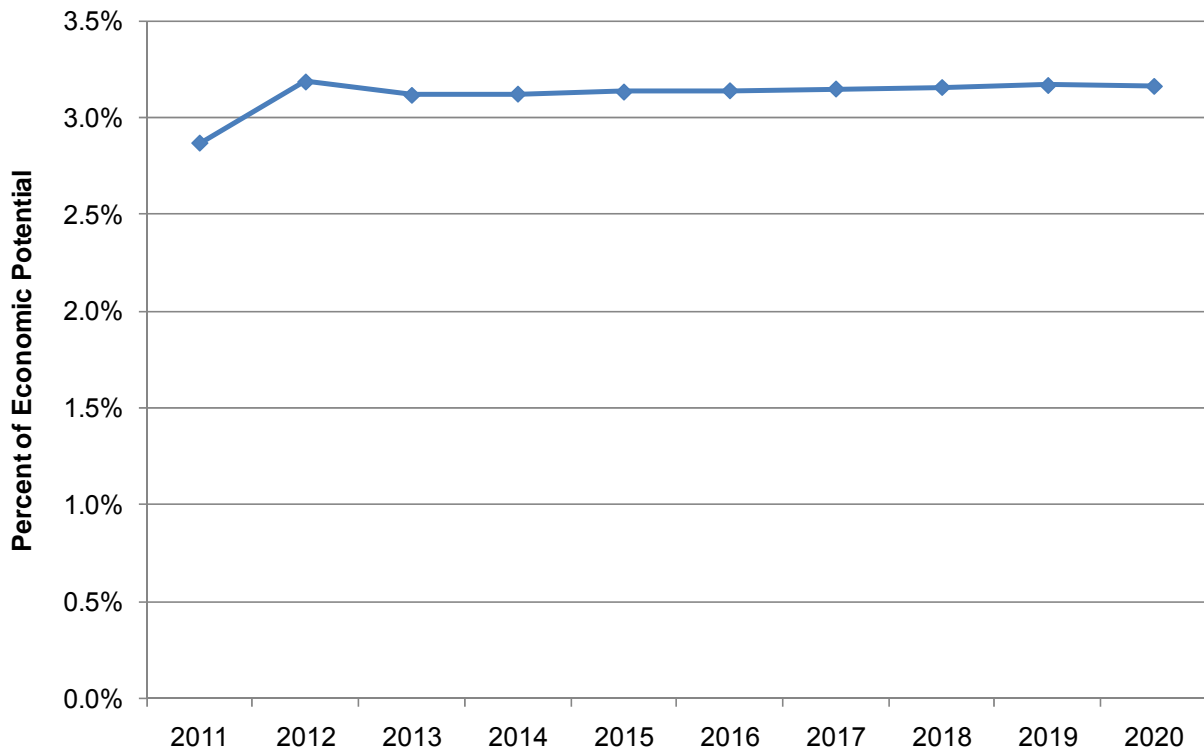


Source: Data obtained from California Energy Efficiency Resource Assessment Model (October 2010).

### Market Savings Potential and Targets

**Figure 49** shows Glendale's energy savings targets as a percentage of economic savings potential. Of the POUs studied, Glendale's targets were flattest.

**Figure 49: Target Energy Savings as a Percentage of Economic Savings Potential—Glendale**

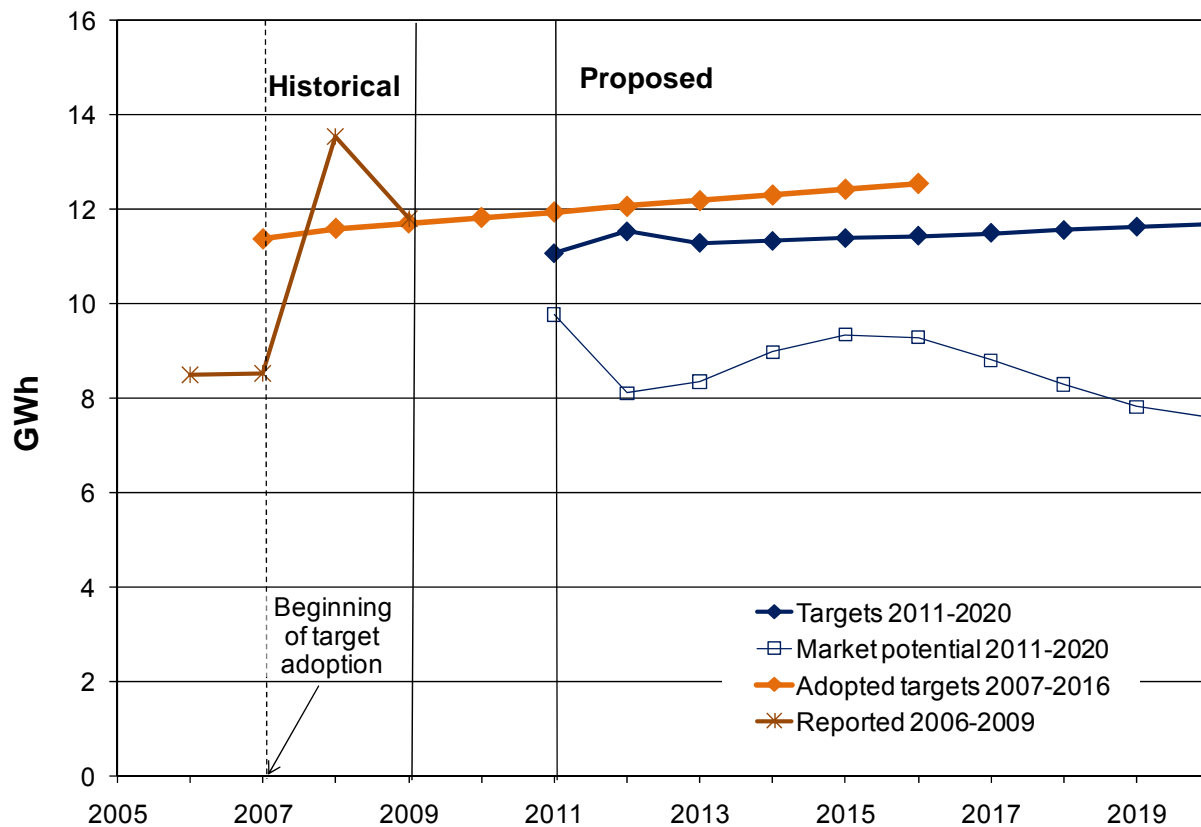


Source: Data obtained from California Municipal Utilities Association, *Energy Efficiency in California's Public Power Sector. A Status Report*, March 2010, combined with California Energy Efficiency Resource Assessment Models (October 2010).

**Figure 50** shows Glendale's new targets for 2011 to 2020 as compared with previous targets, past program savings, and recent estimates of market savings potential. Glendale's new targets are slightly lower than its older targets and increase more slowly. The new targets are also lower than reported savings for both 2008 and 2009.

Glendale's targets do not ramp up significantly, although they do increase slightly with the base energy use forecast.

**Figure 50: Glendale's Historical Annual Energy Efficiency Program Savings and Targets**



Source: Data for 2011-2020 targets obtained from California Municipal Utilities Association, *Energy Efficiency in California's Public Power Sector. A Status Report*, March 2010. Data for 2011-2020 market potential obtained from California Energy Efficiency Resource Assessment Models (October 2010). Data for 2009 reported savings obtained from California Municipal Utilities Association, *Energy Efficiency in California's Public Power Sector. A Status Report*, March 2009. Data for 2007-2016 targets obtained from California Municipal Utilities Association, *Establishing Energy Efficiency Targets: A Public Power Response to AB2021. Final Update*, October 2007.

Glendale's 2011-2020 targets are uniformly higher than their market savings potential. Although 2008 and 2009 savings suggest that the targets may be achievable, at least in the early years, the market savings potential estimates suggest that that level of savings may not be sustainable in the long run.

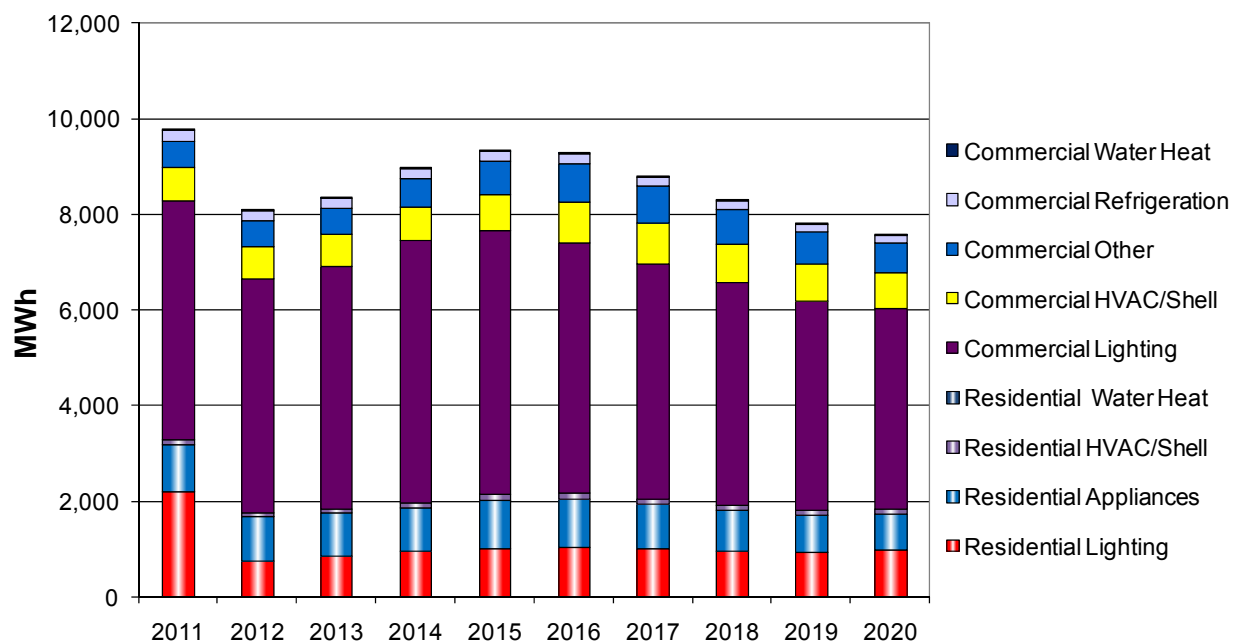
Glendale met its target in 2008 and 2009 after falling short in 2007. This success suggests that Glendale can probably meet its near-term targets with its current programs. The lower market savings potential, however, may become a limiting factor in the long run.

### Market Savings Potential by End Use

KEMA used revised 2010 CalEERAM data to break out market savings potential to show opportunities for specific programs by both customer sector and end use category. **Figure 51** and **Figure 52** show market energy and peak demand savings potential, respectively, by sector

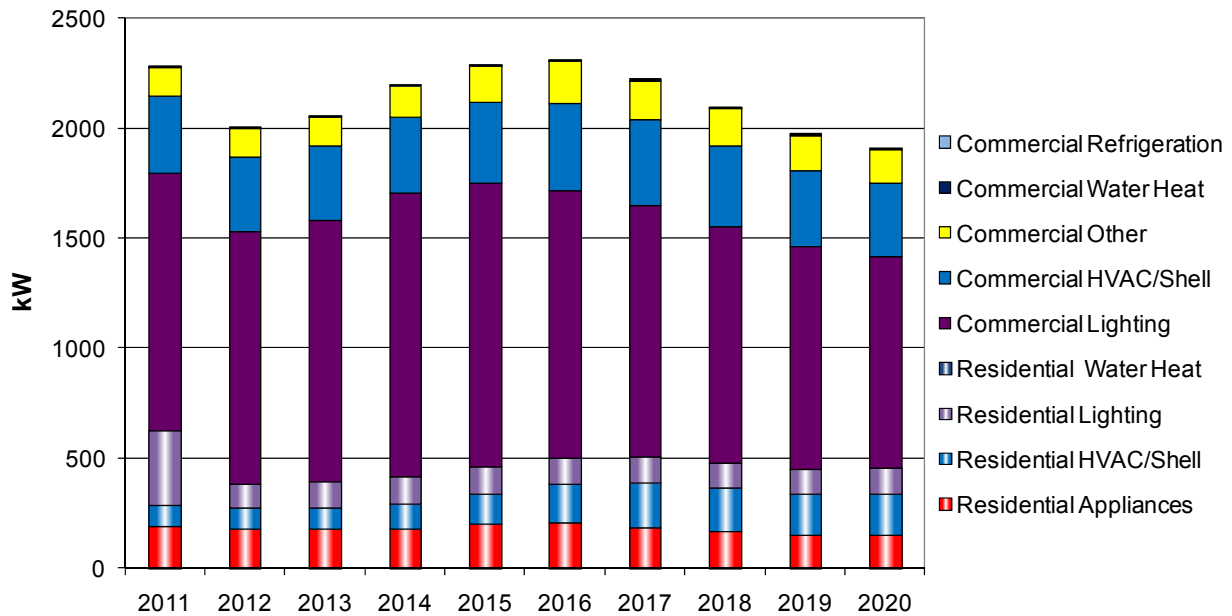
and end use. Commercial lighting is the largest contributor to market energy savings potential. Residential lighting, residential appliances, commercial HVAC/shell, and commercial “other” also contribute significantly to energy savings, with their relative importance varying over the forecast period. Commercial lighting and commercial HVAC are the most significant contributors to market peak demand savings potential.

**Figure 51: Glendale’s Market Savings Potential (MWh) by End Use**



Source: Data obtained from California Energy Efficiency Resource Assessment Model (October 2010).

**Figure 52: Glendale's Market Savings Potential (kW) by End Use**



Source: Data obtained from California Energy Efficiency Resource Assessment Model (October 2010).

## Program Factors Affecting Target Feasibility and Reliability

Glendale can meet its targets only with a realistic vision and credible implementation plan.

Glendale reviews its budgets over a five-year planning horizon but submits a two-year plan to the city council. This approach combines a long-term planning horizon with the ability to adjust budgets and programs to near-term developments. The energy efficiency budget has been growing, but the economic downturn has depressed Glendale's energy use. This may affect future budgets. Glendale receives funding from California's public benefits charge and Senate Bill 1, as a percentage of utility revenue. Despite these factors, Glendale does not expect to reduce any programs.

Glendale has 10 to 12 staffers who work on energy efficiency programs, smart grid projects, and communications and marketing. Contractors perform most of Glendale's energy efficiency program work. Several staffers devote part of their time to managing the contractors. Glendale is in the process of hiring an additional staff person for programs that the utility funds through the public benefits charge. Since their revised targets are slightly lower than previous targets, however, Glendale is not planning to add staff.

Glendale is installing both advanced metering infrastructure and smart grid technologies, and is actively looking for ways to link its programs with new technologies. Of particular interest are the behavioral information programs. While Glendale plans to continue to perform paper-based home energy reports in the near future, it expects to introduce additional information delivery

mechanisms in the future such as meter technologies combined with Web portals. The utility is working with a local vendor to possibly develop an in-home display program.

Glendale expects to promote load shifting by using off-peak electricity to make ice used the next day to deliver cooling directly to a building's existing air-conditioning system. It is also implementing demand response programs for large customers, residential customers, and small businesses.

Citing market saturation, Glendale discontinued its CFL program.

Glendale identified the economy as a potential barrier to meeting its targets. Despite the economic downturn, however, 2010 was Glendale's biggest year for energy efficiency program savings. Glendale speculated that businesses are investing in energy efficiency projects as a way to save money in the weak economy.

Glendale also identified lack of adequate staffing as a potential barrier to meeting its targets.

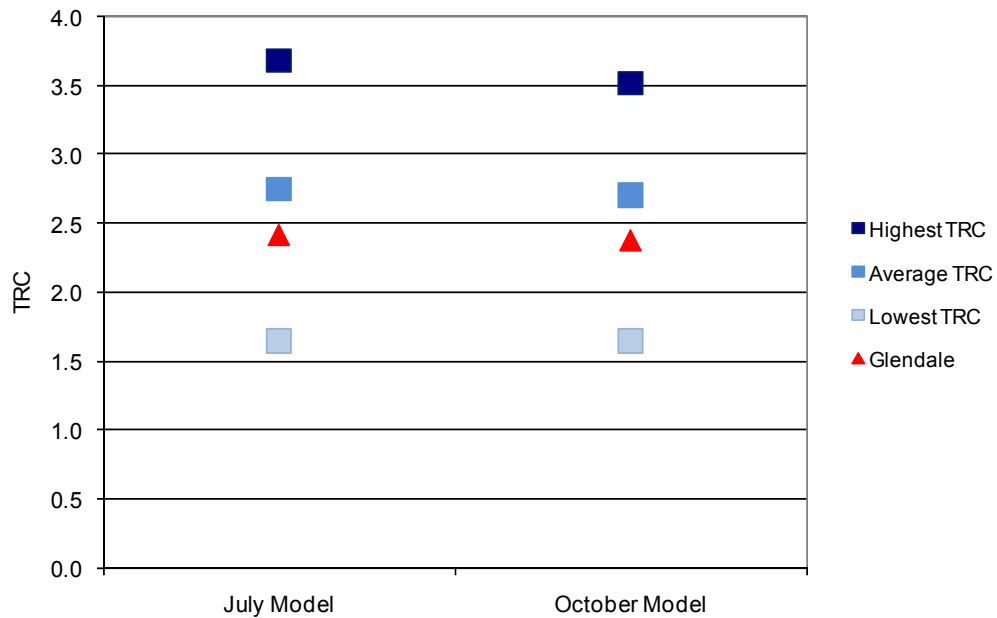
Glendale is working on an EM&V study that it will complete in 2011.

### Program Cost-Effectiveness

Neither available version of the CalEERAM model matches Glendale's targets, so cost-effectiveness metrics for the targets are not available. The July version of the CalEERAM model shows a TRC ratio of 2.42 for the estimated market savings potential, and the October revised version of the model shows a TRC ratio of 2.38. **Figure 53** shows the two TRC ratios for Glendale, as compared with other utilities. Glendale's TRC ratio is slightly lower than average.

The cost per first-year kWh of savings from Glendale's model was 63 cents for residential and 37 cents for nonresidential in 2015, compared to an average of 58 cents for residential and 36 cents for nonresidential across the POU models. Glendale's residential cost is slightly above average for residential and close to average for nonresidential. Again, to meet the targets, Glendale's program would have to be more aggressive than the one modeled, which would tend to increase the cost per kWh.

**Figure 53: Glendale's TRC Ratios From Two CalEERAM Versions, Compared to Other POUs**

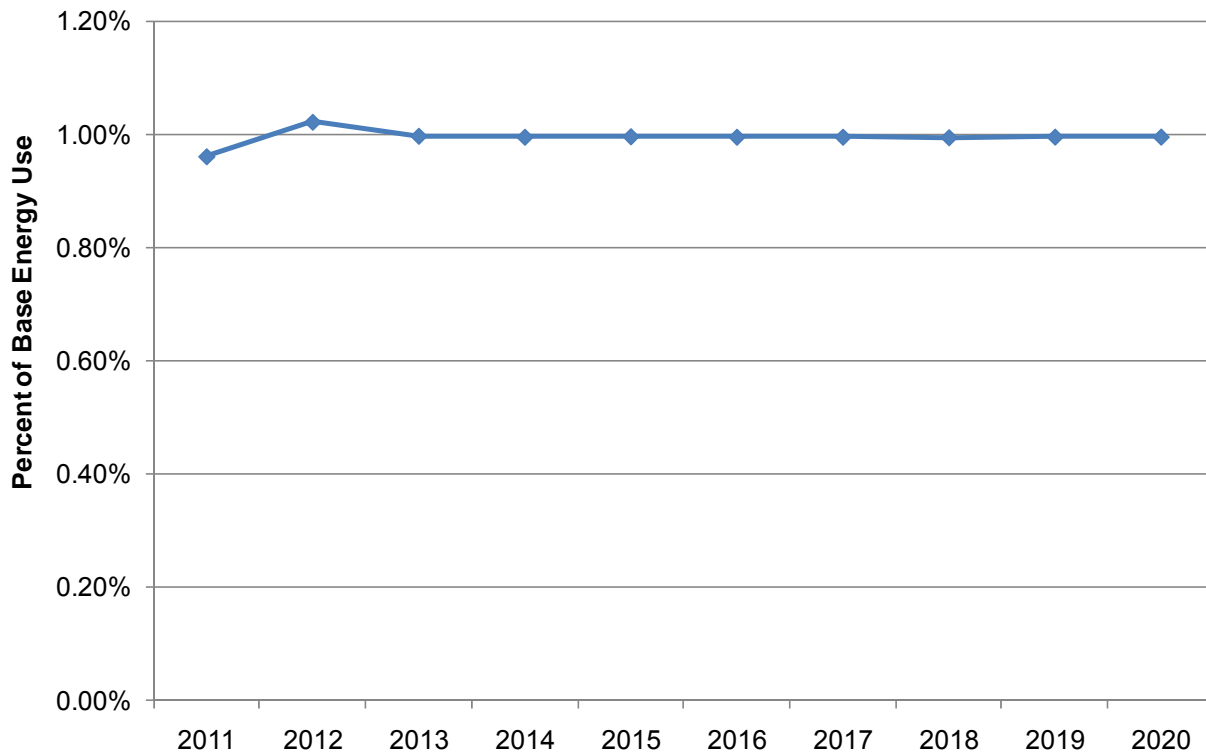


Source: Data obtained from California Energy Efficiency Resource Assessment Model (October 2010) and (July 2010) versions.

### Targets' Contribution to Energy Use Reduction

Successfully meeting its targets will reduce Glendale's electricity use over the forecast period. **Figure 54** shows target energy savings as a percentage of total energy use. Cumulatively, the targets add up to 9.8 percent of forecasted energy use for 2020 (based on the energy use forecast in the CalEERAM model), which is just shy of the AB 2021 10 percent reduction requirement. KEMA believes that Glendale intends to meet the 10 percent goal over 10 years, and that the discrepancy could be due to rounding.

**Figure 54: Target Energy Savings as a Percentage of Base Energy Use—Glendale**



Source: Data obtained from California Municipal Utilities Association, *Energy Efficiency in California's Public Power Sector. A Status Report*, March 2010.

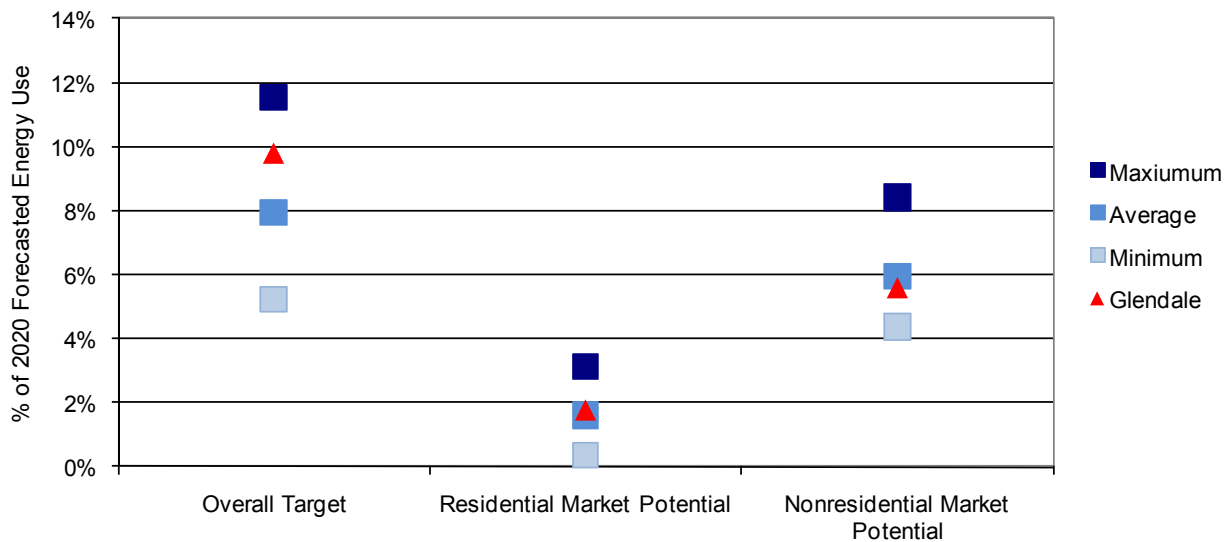
### Assessment of Targets

In this section, KEMA evaluates Glendale's targets by first comparing them with the other 11 POUs, then by evaluating whether they are "adequate" according to AB 2021 criteria (cost-effectiveness, feasibility, reliability, and energy use reduction).

**Figure 55** shows the sum of Glendale's 2011-2020 targets as a percentage of energy use, relative to those of other POUs. The overall target is from the March 2010 CMUA report and represents Glendale's current commitments. Because the CMUA report did not break out targets by sector, **Figure 55** shows the sector breakdowns of market savings potentials from the October 2010 CalEERAM revision.

Glendale's target is among the highest of the 12 utilities in the detailed study. This contrasts with its market savings potentials. Its residential market savings potential is close to average, and its nonresidential savings potential is slightly below average. Unlike most of the other POUs, however, Glendale did not base its targets on market savings potential and chose instead to adopt a more aggressive target.

**Figure 55: Glendale's 10-Year Cumulative Targets Compared With the Largest POUs**



Source: Data obtained from California Municipal Utilities Association, *Energy Efficiency in California's Public Power Sector. A Status Report*, March 2010, combined with California Energy Efficiency Resource Assessment Models (October 2010).

### Summary of Target Adequacy

In this section, KEMA examines the adopted targets across all four AB 2021 target assessment criteria. **Table 19** summarizes the findings. Glendale's targets did not meet either feasibility or reliability requirements. The feasibility of Glendale's targets is questionable since its targets are significantly higher than its estimated market savings potential. While this does raise concern, Glendale's actual 2009 savings exceeded its 2011 market savings potential, indicating that the targets may not be as much of a stretch as the market savings potential suggests. In the area of reliability, Glendale has not completed EM&V on its programs, although it developed an EM&V plan in 2010.

**Table 19: Target Assessment—Glendale**

<b>Target Criterion</b>	<b>Criteria Description</b>	<b>How Well Does It Meet This Criterion?</b>
Cost-Effectiveness	TRC ratio $\geq 1$	TRC ratio = 2.38
Feasibility	<ul style="list-style-type: none"> <li>Revised targets are reasonably related to reported savings (2006-2009)?</li> <li>Revised targets are reasonably related to market savings potential?</li> <li>Annual ramp-up rate in future years is reasonable?</li> <li>Budget and staffing is likely to be in place to achieve targets?</li> </ul>	<p>Targets are slightly below 2008-2009 reported savings.</p> <p>Targets are significantly higher than estimated market savings potential.</p> <p>Targets do not ramp up significantly over the forecast period.</p> <p>Budget and staffing were adequate to achieve comparable savings in 2008 and 2009. Glendale stated that it has adequate staffing and budgets.</p>
Reliability	<ul style="list-style-type: none"> <li>Successfully achieved 2007 targets in most years?</li> <li>Utility performs regular EM&amp;V?</li> </ul>	<p>Glendale met its 2008 and 2009 targets.</p> <p>Glendale is in the process of performing an EM&amp;V study of its programs.</p>
Energy Use Reduction	<ul style="list-style-type: none"> <li>Meets 10% reduction over 10 years?</li> </ul>	<p>Current targets reach 9.8% of 2020 forecasted over 10 years, just short of the target. Each year's target is set to 1 percent of that year's energy use. Because energy use is increasing, the cumulative total falls slightly short of the target. However, it seems clear that it was Glendale's intention to meet legislative requirement, and Glendale may have interpreted how to calculate the 10-year cumulative target differently from KEMA. Because of this, Glendale receives credit for this criterion.</p>

## Options for Increasing Efficiency

Glendale's targets already meet AB 2021's reduction requirement of 10 percent over 10 years. However, the market potential modeled in Glendale's CalEERAM model does not show how the utility will meet that goal.

KEMA altered the inputs to Glendale's model to see what changes would be required for the market savings potential to meet AB 2021 requirement for the 10-year energy use reduction. KEMA then increased Glendale's incentive levels incrementally until market savings potential achieved 10 percent over 10 years. Setting incentives at 60 percent of incremental measure cost produced a 10 percent cumulative savings over 10 years, with an overall TRC ratio of 2.4 and a 2011 cost of 37 cents per first-year kWh (increasing to 66 cents per kWh by 2020). By comparison, Glendale's existing program has an overall TRC ratio of 2.41 and costs about 29 cents per first-year kWh in fiscal year 2008/2009.<sup>37</sup>

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<sup>37</sup> Calculated from program data in CMUA (2010), Table 7.

## Imperial Irrigation District

### Summary of Revised Targets

Efficiency savings for Imperial Irrigation District (Imperial) in fiscal year 2008/2009 represented 1.8 percent of all POU (including SMUD and LADWP) energy efficiency savings (CMUA 2010). Imperial's 2007 targets show a significant increase over its 2006 program savings. Although its savings fell short of its target in 2007, by 2008 Imperial was able to meet the targets set in 2007. The utility did not achieve its 2009 target. Imperial's new targets for 2011 and 2012 are lower than the targets set in 2007. They are also lower than reported savings for 2008 but higher than those for 2009. The targets increase moderately from 2012 through the end of the period. The targets are much lower than the estimated market savings potential throughout the forecast period. The cumulative total of the program savings targets from 2011 through 2020 are equivalent to 5.2 percent of forecasted electricity use for 2020.

### Key Analytical Differences From Other Utilities

Imperial was one of five utilities studied where neither of the CalEERAM models received agreed with the market savings potentials published in CMUA's March 2010 report. The market savings potentials in the model received from Imperial in July were 65 percent higher than were reported in CMUA (2010). The October results were similar to the July version of the model. Without a copy of the model used to estimate the published market savings potentials and targets, KEMA could not fully explain Imperial's results.

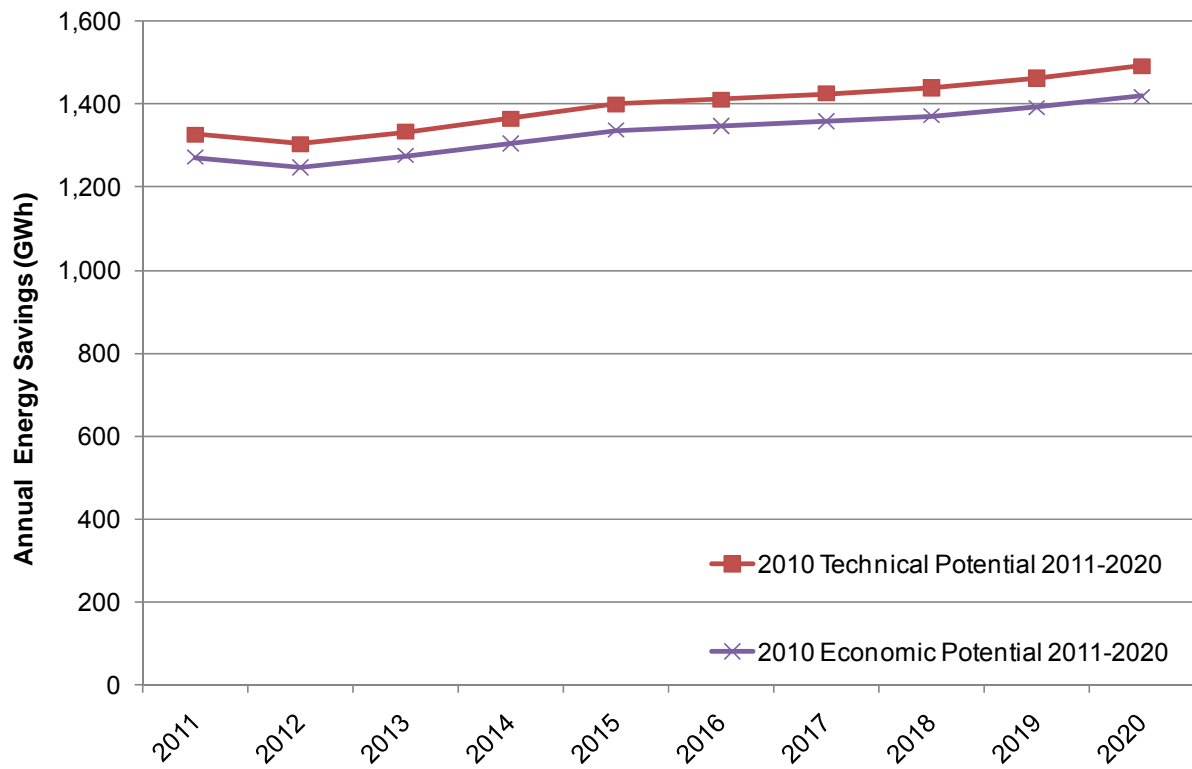
Imperial was the only POU studied where a seasonal energy efficiency ratio (SEER) 16 air conditioner passed the cost-effectiveness test for single-family homes and was one of only two with a passing residential cooling measure.

Imperial has one of the lowest rates of the 12 POUs studied. (See **Figure 17** and **Figure 18**.)

### Technical and Economic Savings Potential

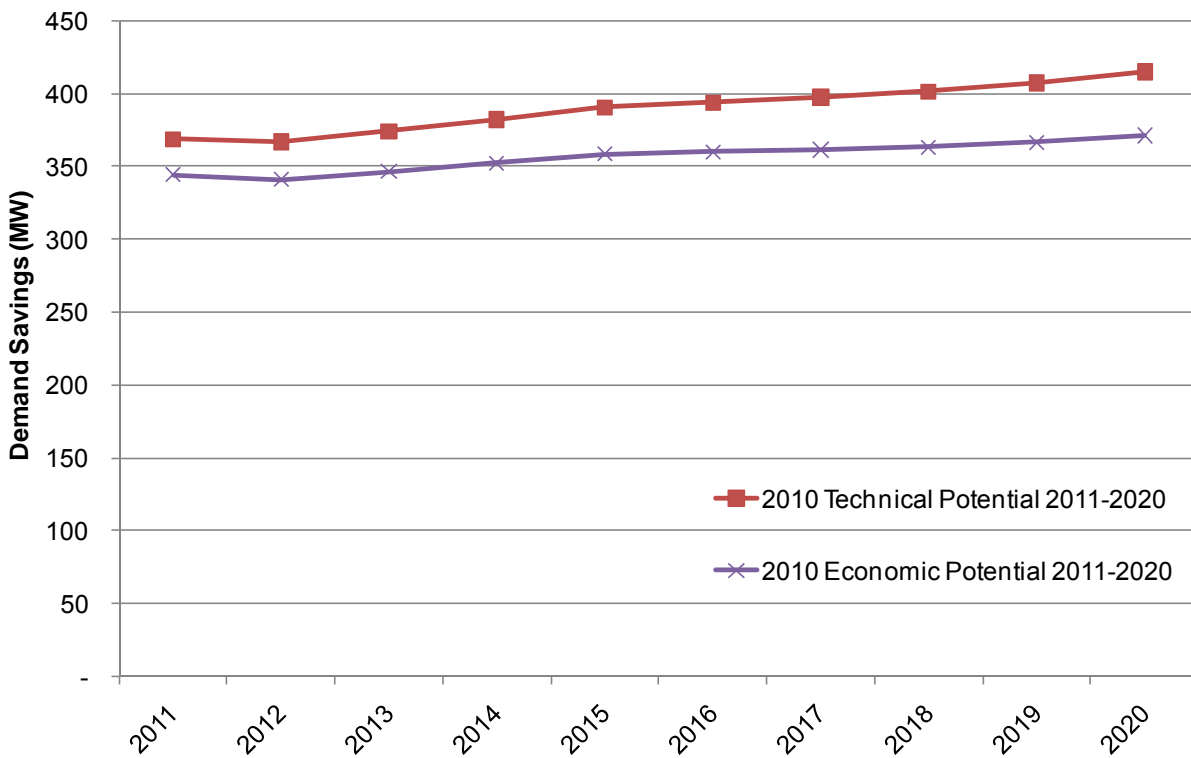
**Figure 56** (energy) and **Figure 57** (demand) show Imperial's technical and economic savings potential, as developed in its revised October 2010 CalEERAM model. Savings dip slightly in 2012 due to implementation of the new federal lighting standard, which will improve the efficiency of baseline lighting and reduce the savings potential for CFLs. Savings then begin climbing through the end of the forecast, averaging 1.7 percent growth per year.

**Figure 56: Technical and Economical Energy Savings Potential (MWh)—Imperial**



Source: Data obtained from California Energy Efficiency Resource Assessment Model (October 2010).

**Figure 57: Technical and Economic Demand Savings Potential (MW)—Imperial**



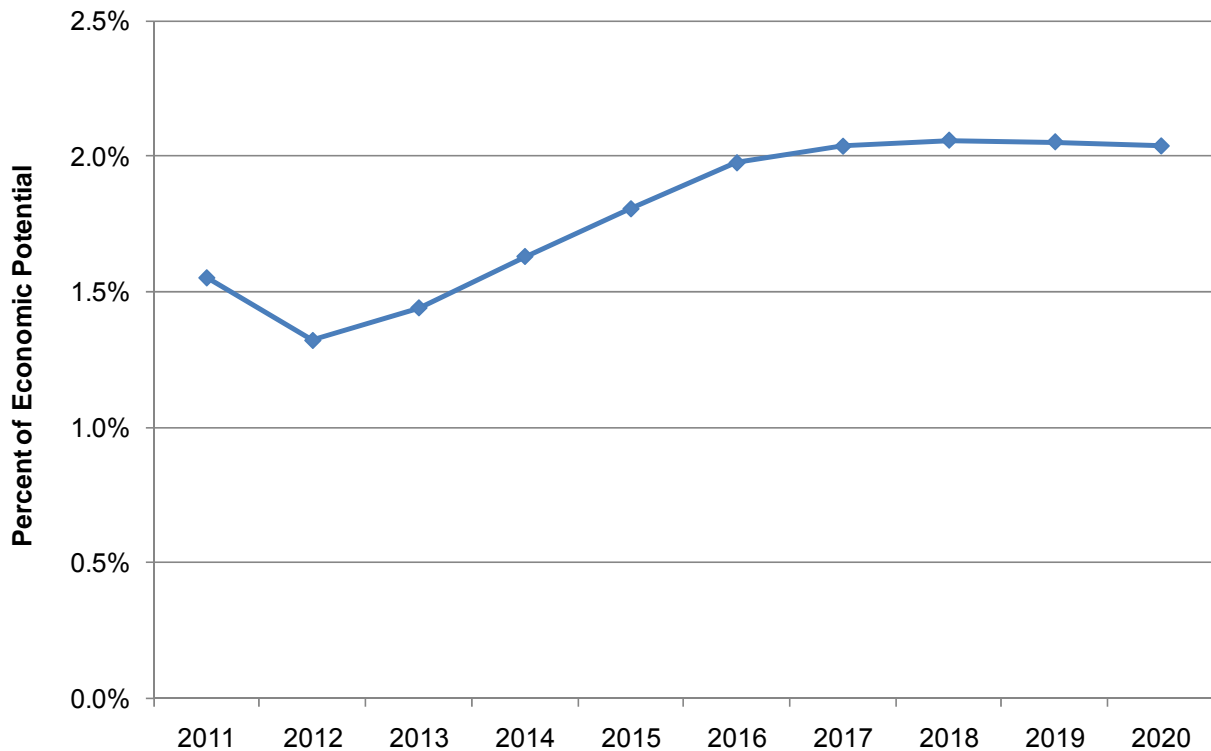
Source: Data obtained from California Energy Efficiency Resource Assessment Model (October 2010).

### Market Savings Potential and Targets

**Figure 58** shows Imperial's energy savings targets as a percentage of economic savings potential. Of the POUs studied, Imperial's cumulative targets were the lowest, as a percent of economic savings potential, at 18 percent. (See **Figure 12** and its accompanying discussion.) The other 12 POUs ranged from 22 to 43 percent and averaged 29 percent of economic savings potential.

Targets of 2 percent or less of economic potential per year, as Imperial's targets are for most years, are very low, even when considering stock turnover and other factors that tend to slow measure penetration.

**Figure 58: Target Energy Savings as a Percentage of Economic Savings Potential—Imperial**

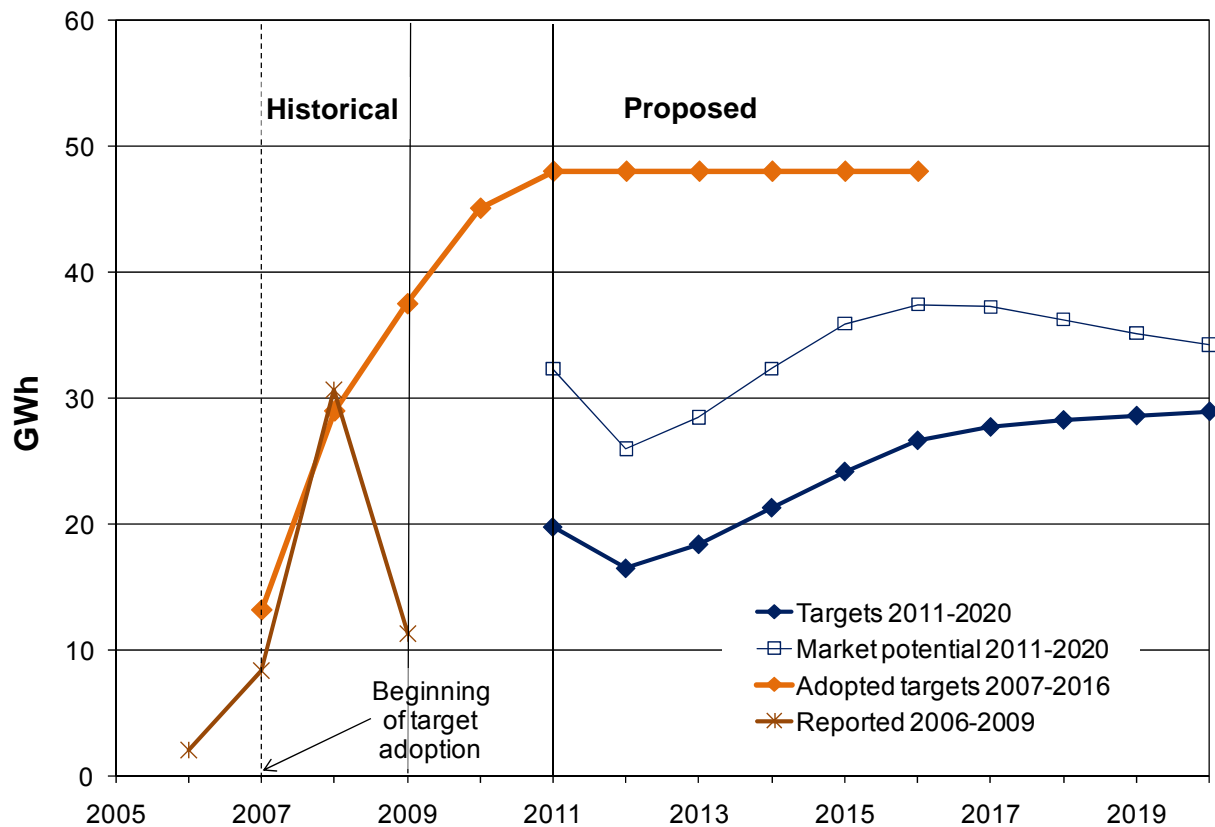


Source: Data obtained from California Municipal Utilities Association, *Energy Efficiency in California's Public Power Sector. A Status Report*, March 2010, combined with California Energy Efficiency Resource Assessment Models (October 2010).

**Figure 59** shows Imperial's revised targets for 2011 to 2020, as compared with previous targets, past program savings, and recent estimates of market savings potential. Imperial's new targets are significantly lower than in its previous targets (the 2011 target was decreased by more than half) and lower than its 2008 reported savings.

The ramp-up rate in Imperial's targets averages 13 percent per year from 2012 to 2016, and the targets continue to increase through 2020.

**Figure 59: Imperial's Historical Annual Energy Efficiency Program Savings and Targets**



Source: Data for 2011-2020 targets obtained from California Municipal Utilities Association, *Energy Efficiency in California's Public Power Sector. A Status Report*, March 2010. Data for 2011-2020 market potential obtained from California Energy Efficiency Resource Assessment Models (October 2010). Data for 2009 reported savings obtained from California Municipal Utilities Association, *Energy Efficiency in California's Public Power Sector. A Status Report*, March 2009. Data for 2007-2016 targets obtained from California Municipal Utilities Association, *Establishing Energy Efficiency Targets: A Public Power Response to AB2021. Final Update*, October 2007.

Imperial's 2011-2020 targets are uniformly lower than its estimated market savings potential,<sup>38</sup> suggesting that the targets should be achievable over the forecast period.

Events in the residential sector drive the decline in market savings potential after 2016. Awareness for most residential measures reaches 100 percent by 2016; without this increasing awareness, the decline in potential participants drives savings: the more customers adopt high-efficiency measures, the smaller the pool of potential participants.

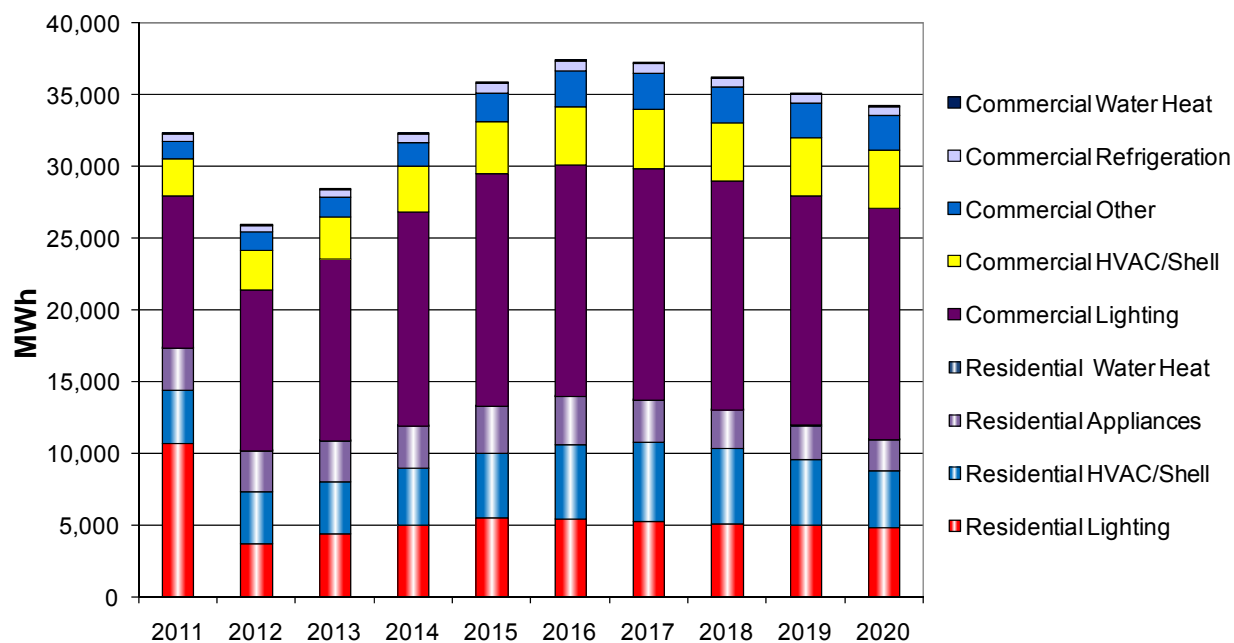
<sup>38</sup> For the March 2010 CMUA report, Imperial's targets were set the same as market savings potential. The model version received by KEMA in July produced market savings potentials that were much higher than those reported in the March Report. (See Figure 4 and its accompanying discussion.)

Imperial met its target in 2008 but fell short by a wide margin in 2009 as its savings declined while its targets increased. The revised 2011 target is between 2008 and 2009's reported savings.

### Market Savings Potential by End Use

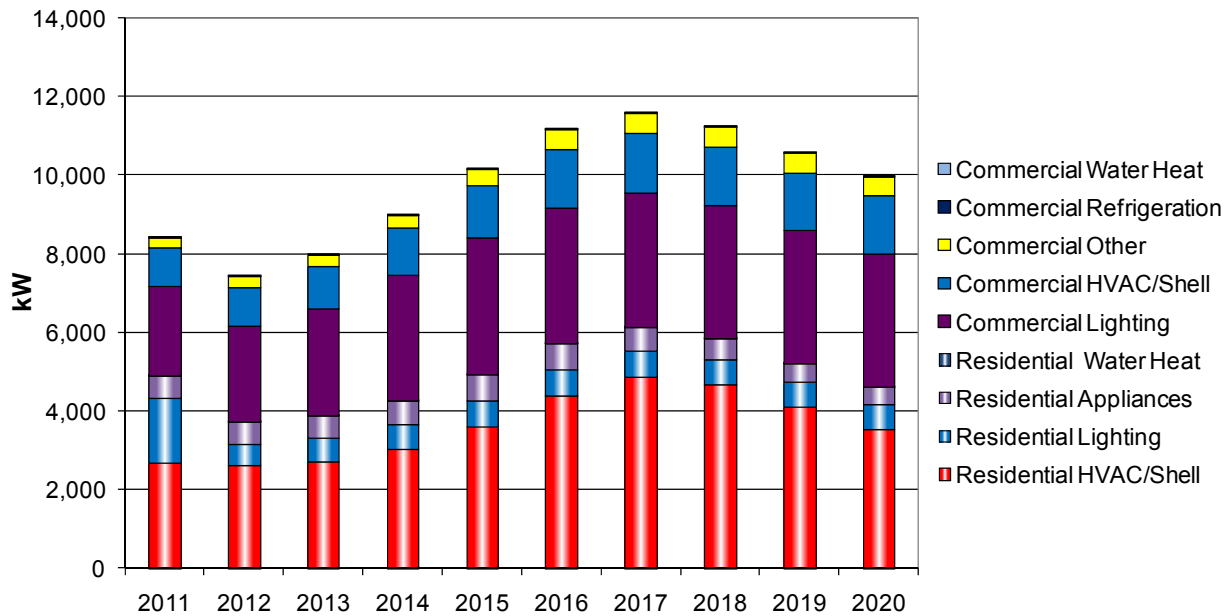
KEMA used revised 2010 CalEERAM data to break out market savings potential to show opportunities for specific programs by both customer sector and end use category. **Figure 60** and **Figure 61** show market energy and peak demand savings potential, respectively, by sector and end use. Commercial lighting is the largest contributor to market energy savings potential. Residential lighting, residential HVAC/shell, and commercial HVAC/shell also contribute significantly to energy savings, with their relative importance varying over the forecast period. Residential HVAC/shell and commercial lighting are the most significant contributors to market peak demand savings potential.

**Figure 60: Imperial's Market Savings Potential (MWh) by End Use**



Source: Data obtained from California Energy Efficiency Resource Assessment Model (October 2010).

**Figure 61: Imperial's Market Savings Potential (kW) by End Use**



Source: Data obtained from California Energy Efficiency Resource Assessment Model (October 2010).

### Program Factors Affecting Target Feasibility and Reliability

Imperial can meet its targets only with adoption of both a realistic vision and a credible implementation plan.

Imperial plans its programs and budgets one year ahead. Beginning in April or May, the staff begins planning the energy efficiency programs that will begin in January of the following year.

Imperial has 13 people who work strictly on energy efficiency. All 13 are new to Imperial, with the exception of 2 who previously worked in different roles at the utility.

Imperial attributed the drop in 2009 savings, in part, to the economic downturn. There was a major management reorganization at Imperial at the beginning of 2010, which reduced staff availability for implementing the utility's energy efficiency programs. Despite these recent changes, Imperial is confident that it will exceed its 2011 targets.

Imperial identified the economy as a possible barrier to meeting its targets. Imperial also cited a lack of energy efficiency staff trained on running its programs. Imperial does not expect that changes to codes and standards will adversely affect its ability to achieve its targets.

Imperial is working on EM&V studies for three of its programs. A draft of the study should be available in spring 2011.

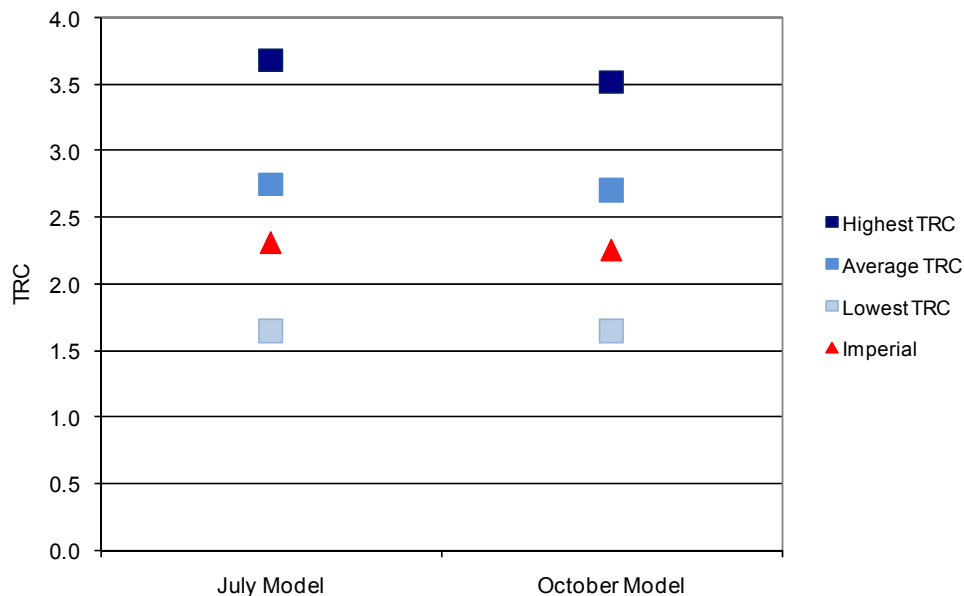
## Program Cost-Effectiveness

Imperial's fiscal year 2008/2009 programs had a TRC ratio of 5.60 (CMUA 2010, Table 7).

Neither available version of the CalEERAM model matches the savings potentials presented in the CMUA March 2010 report, so the cost-effectiveness of the targets is not available. The July version of the CalEERAM model shows a TRC ratio of 2.31 for the estimated market savings potential, and the October revised version of the model shows a TRC ratio of 2.25. **Figure 62** shows the two TRC ratios for Imperial compared with the other utilities. Imperial's TRC ratio is slightly lower than average.

The cost per first-year kWh of savings from Imperial's model was 62 cents for residential and 37 cents for nonresidential in 2015, compared to an average of 58 cents for residential and 36 cents for nonresidential across the POU models studied. Imperial's costs are slightly above average for residential and close to average for nonresidential. Again, to meet the targets, Imperial's program does not need to be as aggressive as the one modeled.

**Figure 62: Imperial's TRC Ratios From Two Versions of CalEERAM, Compared to Other POUs**

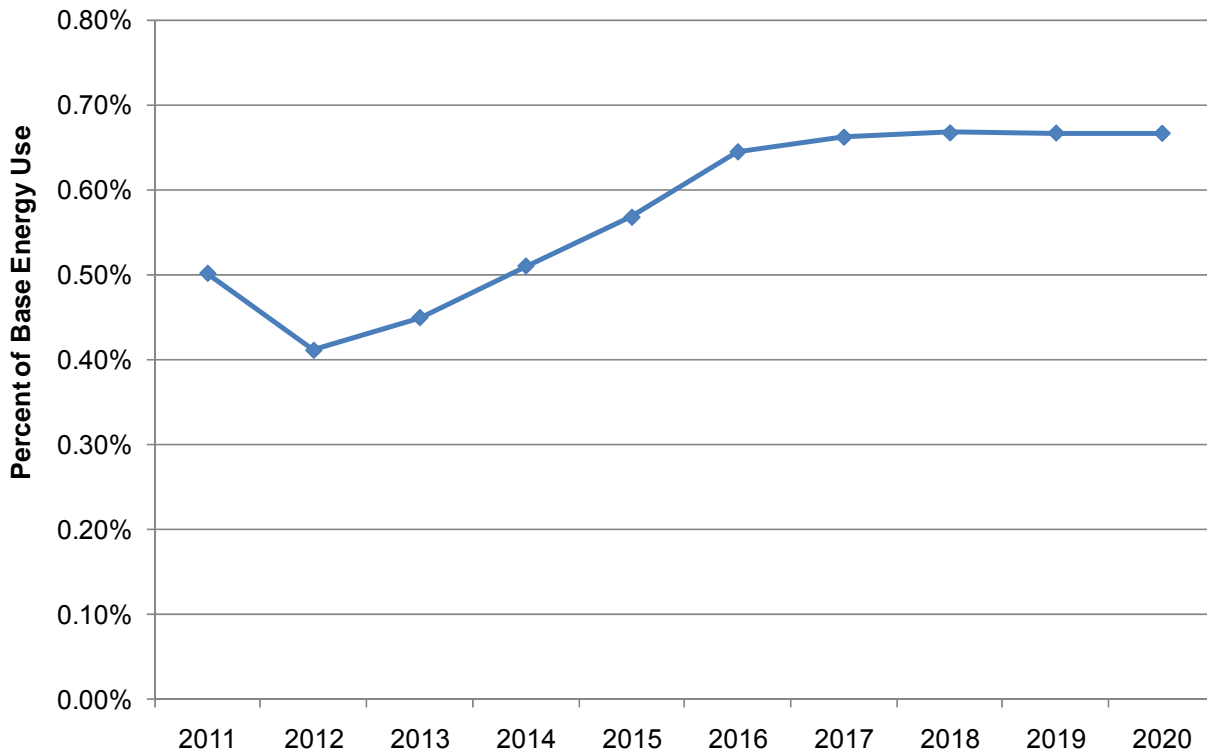


Source: Data obtained from California Energy Efficiency Resource Assessment Model (October 2010) and (July 2010) versions.

## Targets' Contribution to Energy Use Reduction

**Figure 63** shows target energy savings as a percentage of total energy use. Cumulatively, the targets add up to 5.2 percent of forecasted energy use for 2020 (based on the energy use forecast in the CalEERAM model), which still fall short of the 10 percent reduction requirement set forth in AB 2021.

**Figure 63: Target Energy Savings as a Percentage of Base Energy Use—Imperial**



Source: Data obtained from California Municipal Utilities Association, *Energy Efficiency in California's Public Power Sector. A Status Report*, March 2010.

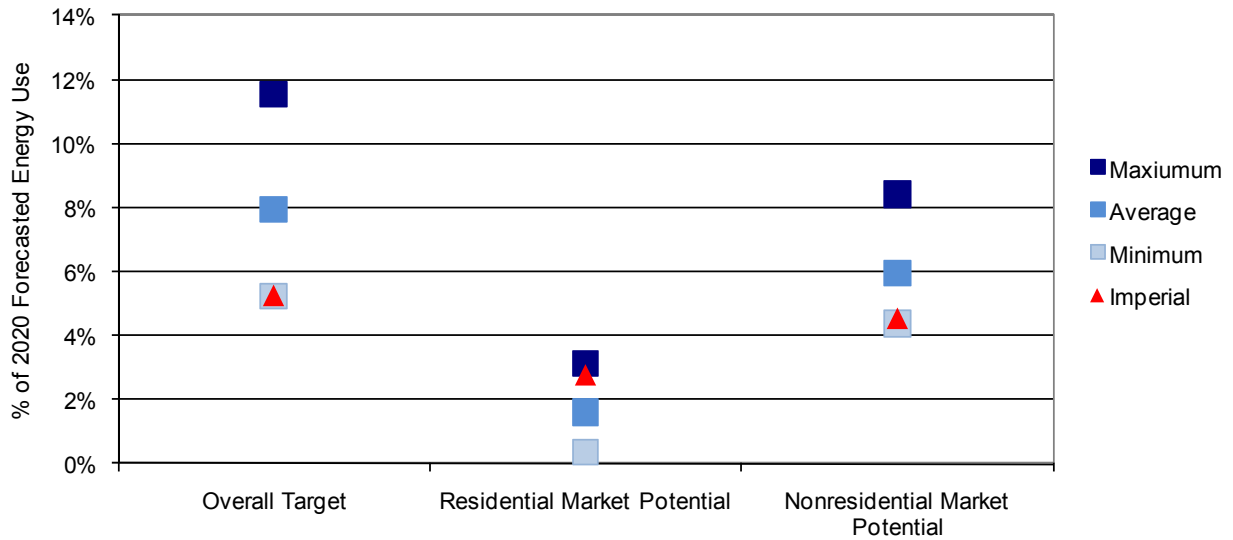
### Assessment of Targets

In this section, KEMA evaluates Imperial's targets first by first comparing them with the other 11 POUs, then evaluating whether they are "adequate" according to AB 2021 criteria (cost-effectiveness, feasibility, reliability and energy use reduction).

**Figure 64** shows the sum of Imperial's 2011-2020 targets as a percentage of energy use, relative to those of other POUs. The overall target is from the March 2010 CMUA report and represents Imperial's current commitments. Because the CMUA report did not break out targets by sector, **Figure 64** shows the sector breakdowns of market savings potentials from the October 2010 CalEERAM revision.

Imperial's target was the lowest of all the 12 utilities in the detailed study. Imperial's market savings potentials, developed later, were split with Imperial's residential market savings potential is among the highest, and its nonresidential savings potential is among the lowest of the 12 utilities.

**Figure 64: Imperial's Targets in Context of 12 of the Largest POUs**



Source: Data obtained from California Municipal Utilities Association, *Energy Efficiency in California's Public Power Sector. A Status Report*, March 2010, combined with California Energy Efficiency Resource Assessment Models (October 2010).

### Summary of Target Adequacy

In this section, reviewers examine adopted targets across all four AB 2021 target assessment criteria. **Table 20** summarizes the findings. Imperial's targets meet only one of the criteria: cost-effectiveness. While Imperial's targets are significantly lower than its estimated market savings potential, its track record for achieving savings is inconsistent, and the 2011 targets are higher than reported savings for 2009. Imperial has not evaluated its programs, although it developed an EM&V plan in 2010. The targets do not meet the 10 percent savings goal of AB 2021.

**Table 20: Target Assessment—Imperial**

Target Criterion	Criteria Description	How Well Does It Meet This Criterion?
Cost Effectiveness	TRC ratio $\geq 1$	TRC ratio = 2.25
Feasibility	<ul style="list-style-type: none"> <li>Revised targets are reasonably related to reported savings (2006-2009)?</li> <li>Revised targets are reasonably related to market savings potential?</li> <li>Annual ramp-up rate in future years is reasonable?</li> <li>Budget and staffing is likely to be in place to achieve targets?</li> </ul>	<p>Targets higher than 2009 but lower than 2008 savings.</p> <p>Targets are much lower than estimated market savings potential.</p> <p>Ramp-up 2012-2015 is moderate and achievable with appropriate budget and staffing.</p> <p>Imperial has expanded its staffing but cited lack of training as a potential barrier to meeting targets.</p>
Reliability	<ul style="list-style-type: none"> <li>Successfully achieved 2007 targets in most years?</li> <li>Utility performs regular EM&amp;V?</li> </ul>	<p>Imperial met its 2008 but not its 2007 or 2009 targets.</p> <p>Imperial is in the process of performing EM&amp;V on its programs.</p>
Energy Use Reduction	<ul style="list-style-type: none"> <li>Meets 10% reduction over 10 years?</li> </ul>	Current targets reach 5.2% of 2020 forecasted energy use over 10 years

### Options for Increasing Efficiency

KEMA altered the inputs to Imperial's model to see what changes would be required for the market savings potential to meet the AB 2021 requirement for a 10-year energy use reduction. KEMA increased Imperial's incentive levels incrementally until market savings potential achieved 10 percent over 10 years. Setting incentives at 60 percent of incremental measure cost produced a 10 percent cumulative savings over 10 years, with an overall TRC ratio of 2.29 and a 2011 cost of 38 cents per first-year kWh (increasing to 69 cents per kWh by 2020). By comparison, Imperial's existing program has an overall TRC ratio of 5.60 and costs about 17 cents per kWh in fiscal year 2008/2009.<sup>39</sup>

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<sup>39</sup> Calculated from program data in CMUA (2010), Table 7.

## Modesto

### Summary of Revised Targets

Efficiency savings for Modesto Irrigation District (Modesto) for fiscal year 2008/2009 represented 2.3 percent of all POU (including SMUD and LADWP) energy efficiency savings (CMUA 2010). Modesto's targets, adopted in 2007, began with 2007 targets that were not much higher than 2006 reported savings but ramped up aggressively over the forecast period. Modesto met its targets in 2007, 2008, and 2009. Modesto's new targets for 2011 and 2012 are higher than the targets set in 2007 but still in line with reported savings for 2008 and 2009. The targets increase aggressively from 2012 to 2016, then decline through 2020. The targets are consistent with estimated market savings potential throughout the forecast period. The cumulative total of the program savings targets from 2011 to 2020 are equivalent to 6.2 percent of forecasted electricity use for 2020.

### Key Analytical Differences From Other Utilities

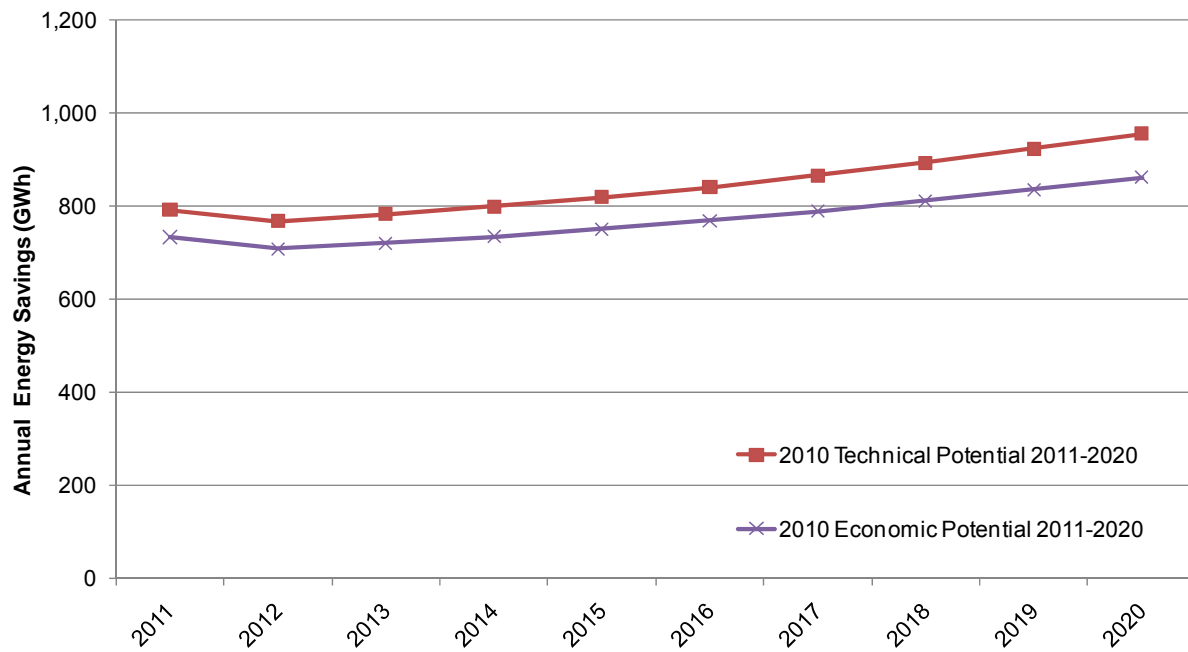
Modesto's CalEERAM model did not have any major, obvious differences from most of the other POUs.

Modesto explicitly included one measure in the analysis, Package system A/C ( $\geq 63.3$  tons, 10.2 EER) for miscellaneous buildings. Modesto did not explicitly exclude any measures.

### Technical and Economic Savings Potential

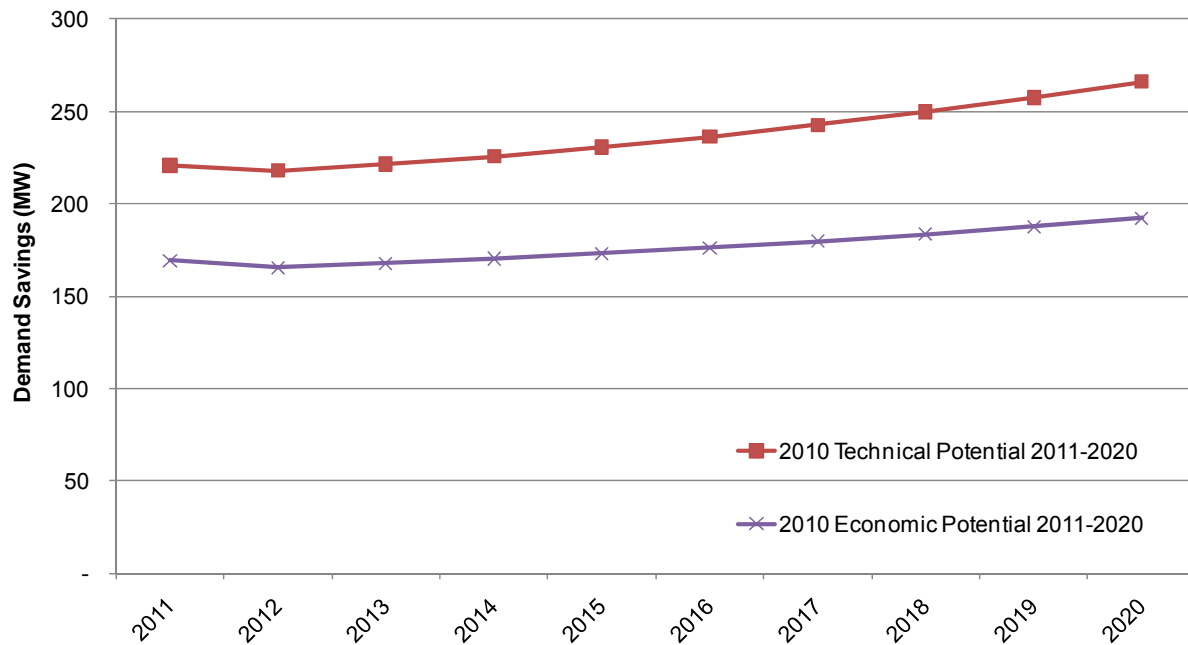
**Figure 65** (energy) and **Figure 66** (demand) show Modesto's technical and economic savings potential, as developed in its revised CalEERAM model from October 2010. Savings dip slightly in 2012 due to new federal lighting standard standards that will improve the efficiency of baseline lighting and reduce the savings potential for CFLs. Savings then begin climbing through the end of the forecast, averaging 2.8 percent growth per year.

**Figure 65: Technical and Economical Energy Savings Potential (MWh)—Modesto**



Source: Data obtained from California Energy Efficiency Resource Assessment Model (October 2010).

**Figure 66: Technical and Economic Demand Savings Potential (MW) —Modesto**

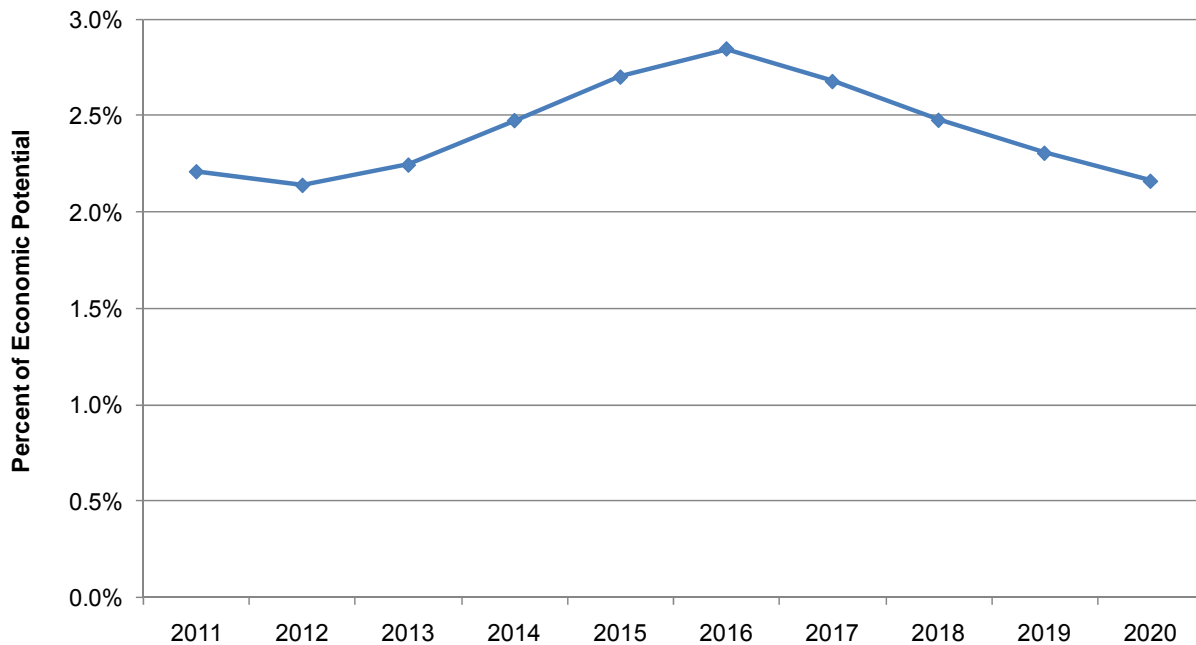


Source: Data obtained from California Energy Efficiency Resource Assessment Model (October 2010).

### Market Savings Potential and Targets

**Figure 67** shows Modesto's energy savings targets as a percentage of economic savings potential.

**Figure 67: Target Energy Savings as a Percentage of Economic Savings Potential—Modesto**

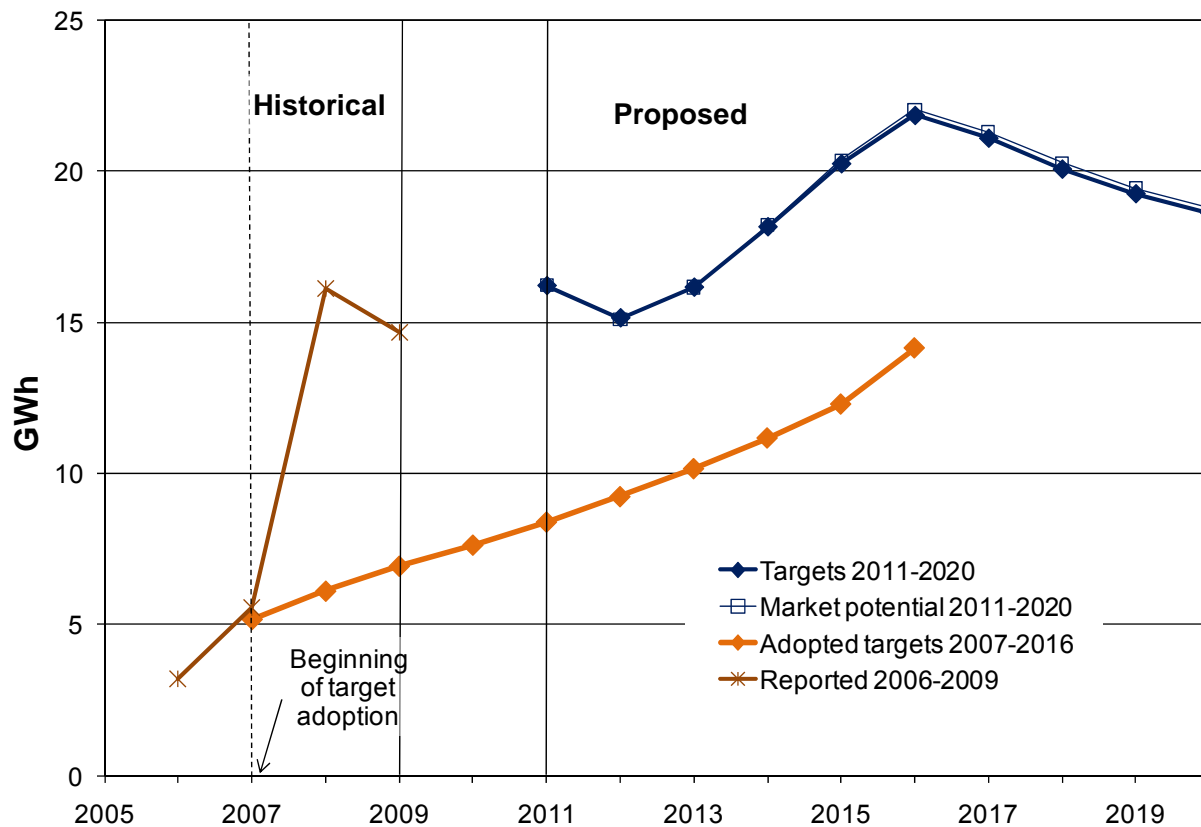


Source: Data obtained from California Municipal Utilities Association, *Energy Efficiency in California's Public Power Sector. A Status Report*, March 2010, combined with California Energy Efficiency Resource Assessment Models (October 2010).

**Figure 68** shows Modesto's new targets for 2011 to 2020 compared with previous targets, past program savings, and recent estimates of market savings potential. Modesto's new targets are notably higher than even in 2011 (although consistent with 2008 and 2009 savings), and they climb from 2012 to 2015.

The rate of ramp-up in Modesto's targets is moderately steep compared with other utilities, with annualized growth of almost 10 percent between 2012 and 2016. (See **Figure 25** and its accompanying discussion.)

**Figure 68: Modesto Historical Annual Energy Efficiency Program Savings and Targets**



Source: Data for 2011-2020 targets obtained from California Municipal Utilities Association, *Energy Efficiency in California's Public Power Sector. A Status Report*, March 2010. Data for 2011-2020 market potential obtained from California Energy Efficiency Resource Assessment Models (October 2010). Data for 2009 reported savings obtained from California Municipal Utilities Association, *Energy Efficiency in California's Public Power Sector. A Status Report*, March 2009. Data for 2007-2016 targets obtained from California Municipal Utilities Association, *Establishing Energy Efficiency Targets: A Public Power Response to AB2021. Final Update*. October 2007.

Modesto's 2011-2020 targets are very close to its market savings potential.<sup>40</sup> New lighting standards in the nonresidential sector, particularly offices and industrial, drive the decline in market savings potential after 2016. Awareness for many measures reaches 100 percent by 2016; without this increasing awareness, the decline in potential participants drives savings: the more customers who adopt high-efficiency measures, the smaller the pool of potential participants.

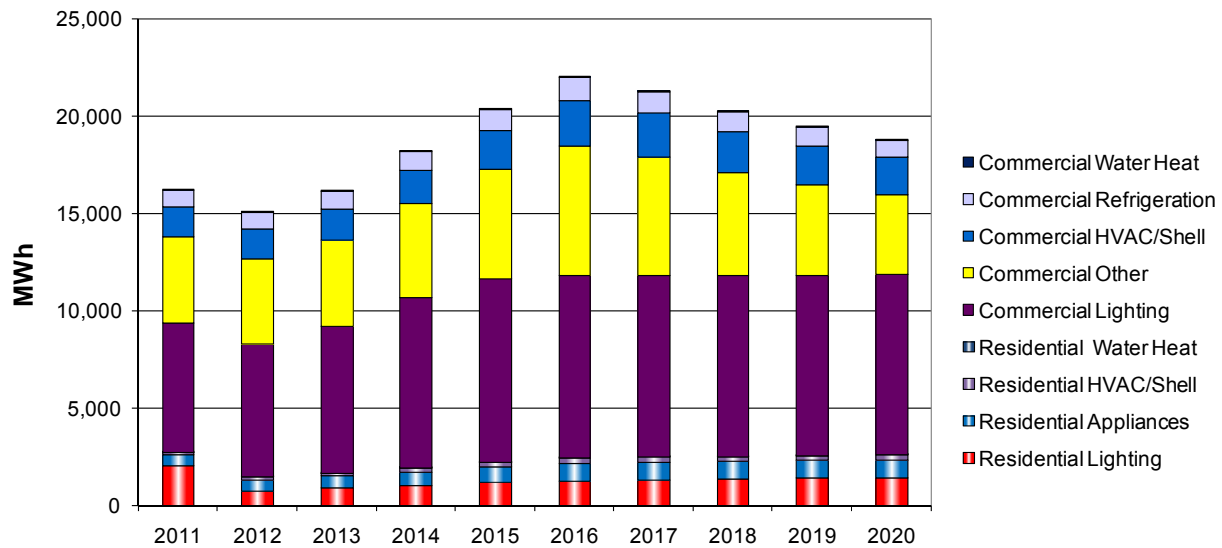
Modesto met its target in 2007, 2008, and 2009. This success indicates that Modesto can probably meet its 2011 to 2013 targets with its current programs, but that it might need additional effort to reach targets in 2014 and beyond.

<sup>40</sup> For the March 2010 CMUA report, Modesto's targets were set the same as market savings potential.

## Market Savings Potential by End Use

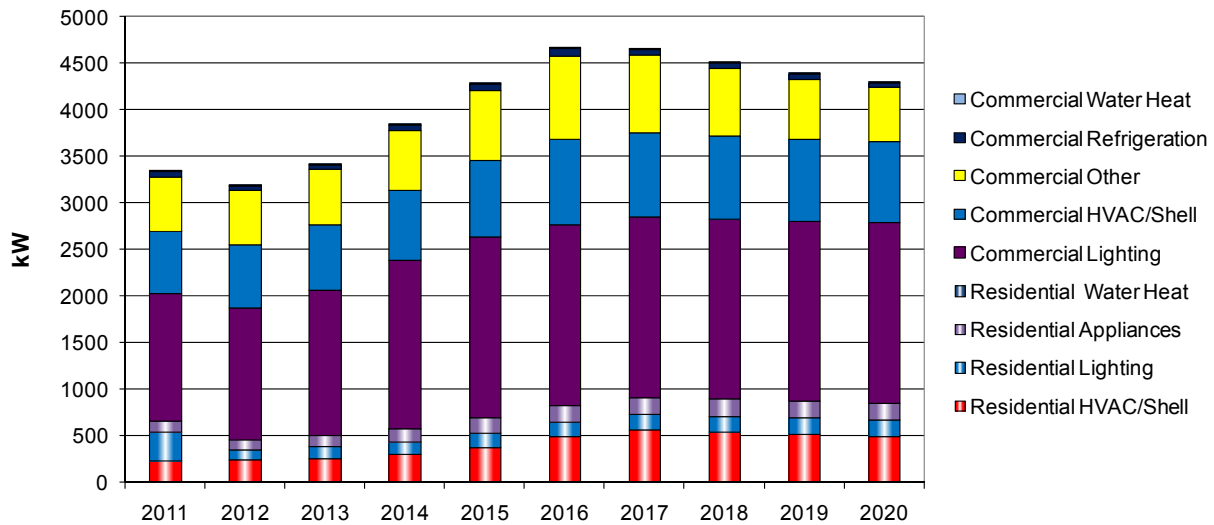
KEMA used revised 2010 CalEERAM data to disaggregate market savings potential to show opportunities for specific programs by both customer sector and end use category. **Figure 69** and **Figure 70** show market energy and peak demand savings potential, respectively, by sector and end use. Commercial lighting is the largest contributor to market energy savings potential, followed by commercial “other.” Commercial lighting, commercial HVAC, and commercial “other” are the most significant contributors to market peak demand savings potential.

**Figure 69: Modesto’s Market Savings Potential (MWh) by End Use**



Source: Data obtained from California Energy Efficiency Resource Assessment Model (October 2010).

**Figure 70: Modesto's Market Savings Potential (kW) by End Use**



Source: Data obtained from California Energy Efficiency Resource Assessment Model (October 2010).

### Program Factors Affecting Target Feasibility and Reliability

Modesto sets budgets on a one-year, calendar-year cycle but looks ahead five years for planning purposes. A special district that are not affiliated with the City of Modesto's budget administers Modesto's budgets are administered.

Due to adverse economic conditions, Modesto's load forecast has declined 5 percent, as compared with the forecast that went into its CalEERAM model.

Modesto's program development horizon is a little shorter than its five-year budget planning horizon to more quickly take advantage of changing factors such as technological advances.

Modesto currently has 3 full-time and 4 part-time staffers working on energy efficiency programs. In total, the equivalent of 4 to 4.5 full-time staffers currently works on energy efficiency. These staff members have extensive experience with energy efficiency. In response to Modesto's decreasing load, however, the utility has instituted a hiring freeze. Across the entire district, including water services, Modesto had 50 open positions at the time of its interview for this report. Modesto plans to hire more contractors in the future.

Barring technological breakthroughs (for example, LEDs), Modesto expects to continue its current programs and measures. Lighting has been one of Modesto's best savings programs. Modesto expects that to continue, but at lower levels because of coming federal lighting efficiency standards. Modesto has already discontinued CFLs from its programs. Given the poor current economic conditions, Modesto expects to ease customer upfront costs through more direct install programs.

The CalEERAM model helped identify some areas that Modesto may want to examine in the future, but the utility does not expect to make any near-term changes to its programs. Modesto

anticipates that, as markets continue to change, it will need to identify and pursue additional sources of savings.

Modesto regularly tests its new programs and performs pilots. Some of these programs include direct install commercial lighting (which might launch this year), refrigerator gasket programs, a grocery/supermarket program, and multifamily duct sealing.

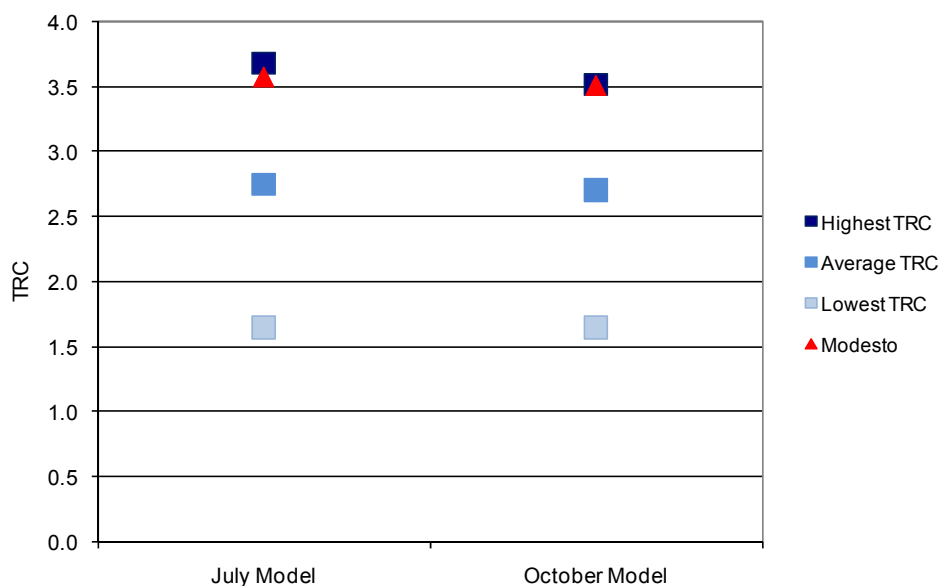
Modesto is seeking a contractor to evaluate its 2010 program.

## Program Cost-Effectiveness

Modesto's fiscal year 2008/2009 programs had a TRC ratio of 2.01 (CMUA 2010, Table 7). The CalEERAM model used to set the targets shows a TRC ratio of 3.58. The error in the version of the model used to create this value increases the uncertainty of this estimate, so reviewers additionally studied the TRC ratio associated with the market savings potential from the revised CalEERAM, which is 3.51. **Figure 71** shows the two TRC ratios for Modesto, compared with the other utilities. Modesto's TRC ratio is among the highest of the 12 utilities in the detailed study.

The cost per first-year kWh of savings from Modesto's model was 56 cents for residential and 28 cents for nonresidential in 2015, compared to an average of 58 cents for residential and 36 cents for nonresidential across the POU models studied. Modesto's cost is close to average for residential and the lowest of the 12 utilities for nonresidential.

**Figure 71: Modesto's TRC Ratios From Two Versions of CalEERAM, Compared to Other POUs**

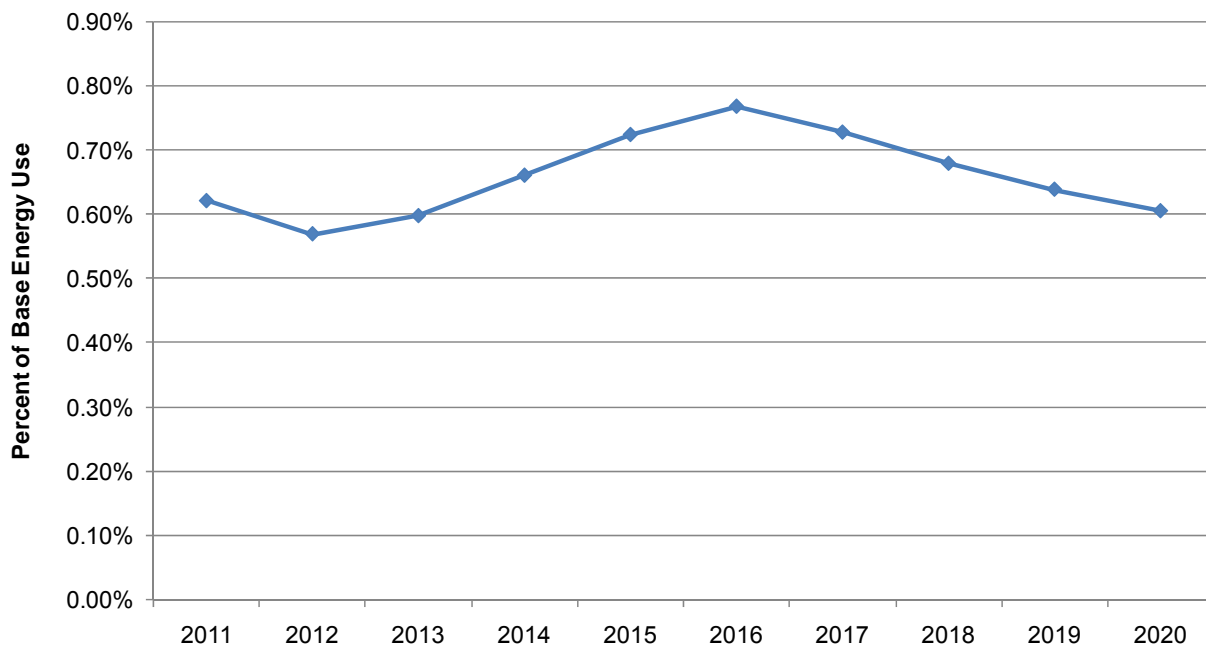


Source: Data obtained from California Energy Efficiency Resource Assessment Model (October 2010) and (July 2010) versions.

## Targets' Contribution to Energy Use Reduction

**Figure 72** shows target energy savings as a percentage of total energy use. Cumulatively, the targets add up to 6.2 percent of forecasted energy use for 2020 (based on the energy use forecast in the CalEERAM model), which falls short of the AB 2021 10 percent reduction requirement.

**Figure 72: Target Energy Savings as a Percentage of Base Energy Use—Modesto**



Source: Data obtained from California Municipal Utilities Association, *Energy Efficiency in California's Public Power Sector. A Status Report*, March 2010.

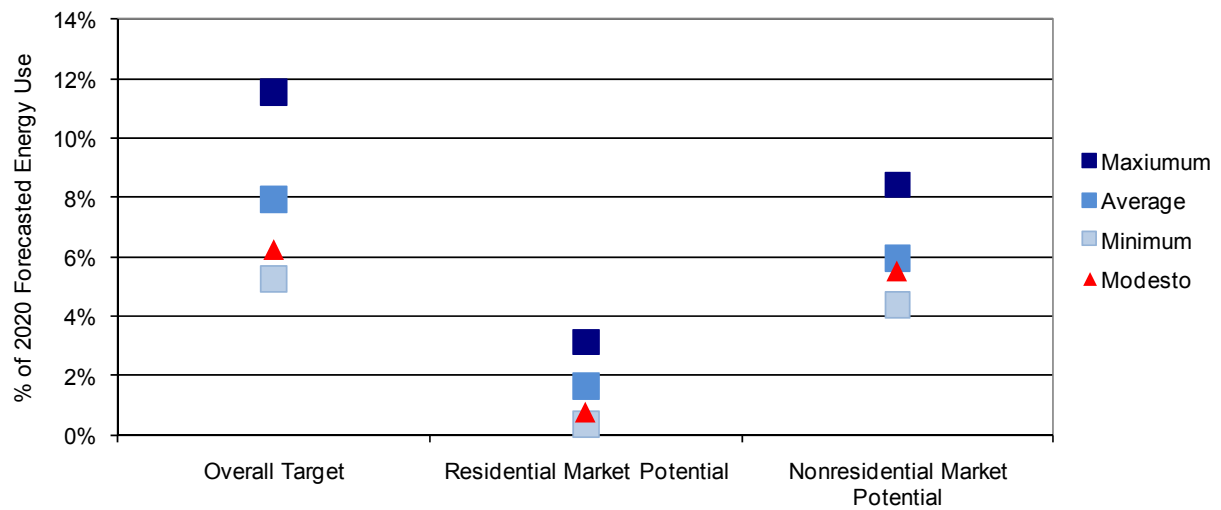
## Assessment of Targets

In this section, KEMA evaluates Modesto's targets first by comparing them with the other 11 POUs, then by evaluating whether they are "adequate" relative to the AB 2021 criteria (cost-effectiveness, feasibility, reliability, and energy use reduction).

**Figure 73** shows the sum of Modesto's 2011-2020 targets as a percentage of energy use, compared with those of other POUs. The overall target is from the March 2010 CMUA report and represents Modesto's current commitments. Because the CMUA report did not break out targets by sector, **Figure 73** shows the sector breakdowns of market savings potentials from the October 2010 CalEERAM revision.

Modesto's target is among the lowest of the 12 utilities in the detailed study. Modesto's residential market savings potential is among the lowest, and its nonresidential savings potential is slightly below average.

**Figure 73: Modesto's 10-Year Cumulative Targets Relative to the 12 Largest POUs**



Source: Data obtained from California Municipal Utilities Association, *Energy Efficiency in California's Public Power Sector. A Status Report*, March 2010, combined with California Energy Efficiency Resource Assessment Models (October 2010).

### Summary of Target Adequacy

In this section KEMA examines adopted targets across all four AB 2021 target assessment criteria. **Table 21** summarizes the findings. Modesto's targets do not meet either reliability or energy use reduction criteria.

**Table 21: Target Assessment—Modesto**

Target Criterion	Criteria Description	How Well Does It Meet This Criterion?
Cost-Effectiveness	TRC ratio $\geq 1$	TRC ratio = 3.51
Feasibility	<ul style="list-style-type: none"> <li>Revised targets are reasonably related to reported savings (2006-2009)?</li> <li>Revised targets are reasonably related to market savings potential?</li> <li>Annual ramp-up rate in future years is reasonable?</li> <li>Budget and staffing is likely to be in place to achieve targets?</li> </ul>	<p>Targets are in line with 2008-2009 reported savings.</p> <p>Targets are consistent with estimated market savings potential.</p> <p>Ramp-up 2012-2015 is moderately aggressive but achievable with appropriate budget and staffing.</p> <p>Additional budget and staffing may be required to meet targets.</p>
Reliability	<ul style="list-style-type: none"> <li>Successfully achieved 2007 targets in most years?</li> <li>Utility performs regular EM&amp;V?</li> </ul>	<p>Modesto more than doubled its savings from 2006-2009 and met its 2008 and 2009 targets.</p> <p>Modesto completed an EM&amp;V study of its 2009 programs.</p>
Energy Use Reduction	<ul style="list-style-type: none"> <li>Meets 10% reduction over 10 years?</li> </ul>	Current targets reach 6.2% of base use over 10 years

### Options for Increasing Efficiency

KEMA altered the inputs to Modesto's model to see what changes would be required for the market savings potential to meet the AB 2021 10-year energy use reduction requirement. KEMA increased Modesto's incentive levels incrementally until market savings potential reached 10 percent over 10 years. Setting incentives at 72 percent of incremental measure cost produced a 10 percent cumulative savings over 10 years, with an overall TRC ratio of 3.11 and a 2011 cost of 34 cents per first-year kWh (increasing to 63 cents per kWh by 2020). By comparison, Modesto's existing program has an overall TRC ratio of 2.01 and costs about 23 cents per kWh in fiscal year 2008/2009.<sup>41</sup>

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<sup>41</sup> Calculated from program data in CMUA (2010) Table 7.

## Palo Alto

### Summary of Revised Targets

Efficiency savings for City of Palo Alto Utilities (Palo Alto) in fiscal year 2008/2009 represented 0.7 percent of all POU (including SMUD and LADWP) energy efficiency savings (CMUA 2010). Palo Alto's 2007 targets were a third higher than its 2006 program savings. Palo Alto met its targets in 2007 through 2009. Palo Alto's revised 2010 targets for 2011 and 2012 are higher than both its 2007 targets and 2009 reported savings. The targets are consistent with its continuing program expansion and comparable with its program increase between 2006 and 2009. The revised targets continue to increase through 2015, then flatten. The targets are close to market savings potentials in 2011 through 2013 but lower than market savings potential in later years. The cumulative total of the program savings targets from 2011 to 2020 are equivalent to 7.4 percent of forecasted electricity use for 2020.

### Key Analytical Differences From Other Utilities

Palo Alto's CalEERAM had many analytical differences compared with the other 11 POU models studied:

- Palo Alto was one of four utilities to set targets different from the market savings potentials published in CMUA (2010).
- It was the only one of the 12 to model food stores.
- The model explicitly included clothes washers, dishwashers, water heaters, ceiling insulation, and wall insulation, even though they failed the TRC test.
- Line loss rates were set to 4.5 percent, compared with 3.69 percent for most of the other utilities.
- Palo Alto's rates were among the highest, and it had the steepest rate increases over the forecast period.
- Palo Alto was one of two utilities to use a different avoided cost forecast. Unlike the other utilities studied, Palo Alto had very similar summer and winter on-peak costs.. (Winter avoided costs were lower for the other utilities.)
- Palo Alto's model assumes an administrative cost factor two times higher than that of the other utilities.

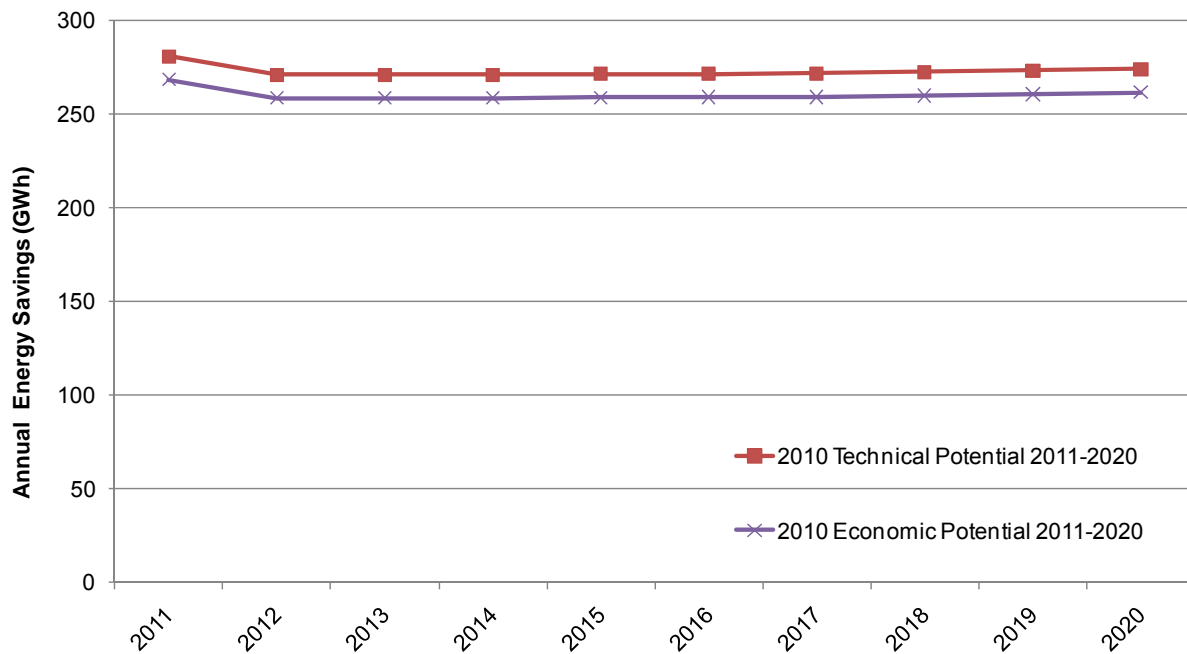
Palo Alto has one of the lowest shares of residential energy use of all the utilities, at 16 percent. This means that nonresidential results dominated Palo Alto's savings potentials.

Of the 12 utilities in the detailed study, only Palo Alto offers both gas and electric service. This may have affected Palo Alto's choice to include clothes washers, dishwashers, and insulation measures in its analysis, even though the electricity savings did not justify their inclusion. Clothes washers and dishwashers save natural gas through water heating, while insulation saves energy for both space cooling and space heating (which is predominantly natural gas in California's urban areas).

## Technical and Economic Savings Potential

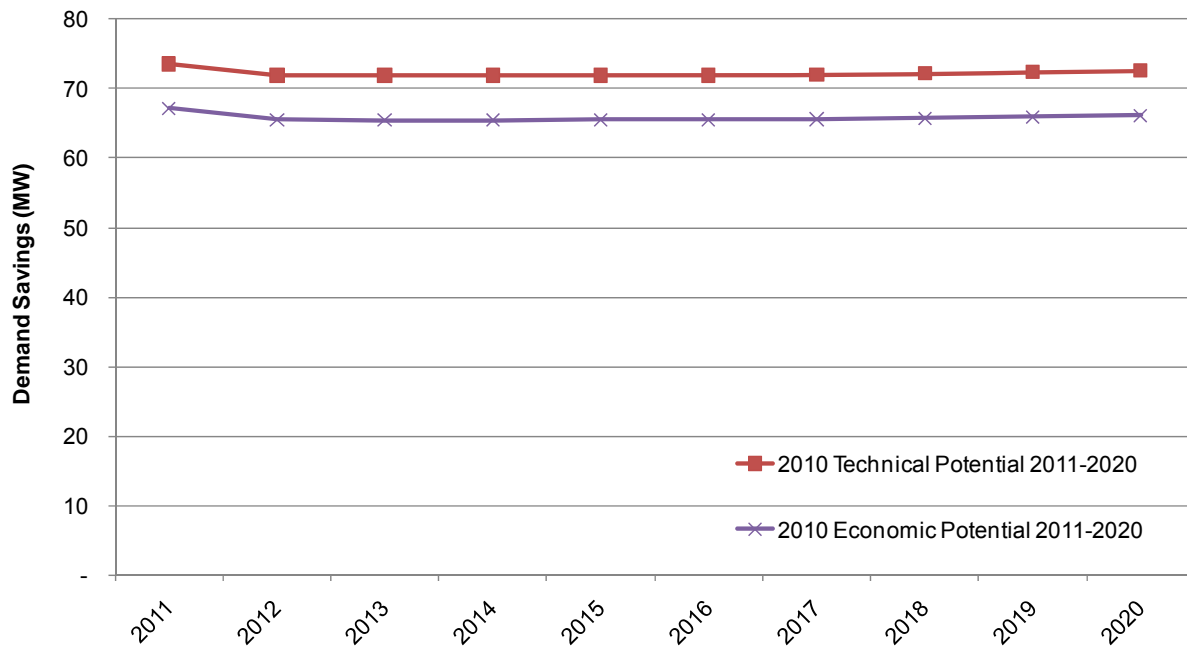
**Figure 74** (energy) and **Figure 75** (demand) show Palo Alto's technical and economic savings potential, as developed in its revised October 2010 CalEERAM model. Savings dip slightly in 2012 due to new federal lighting standards, which will improve the efficiency of baseline lighting and reduce the savings potential for CFLs. Savings are then virtually flat through the forecast, averaging only 0.1 percent growth per year.

**Figure 74: Technical and Economical Energy Savings Potential (MWh)—Palo Alto**



Source: Data obtained from California Energy Efficiency Resource Assessment Model (October 2010).

**Figure 75: Technical and Economic Demand Savings Potential (MW)—Palo Alto**

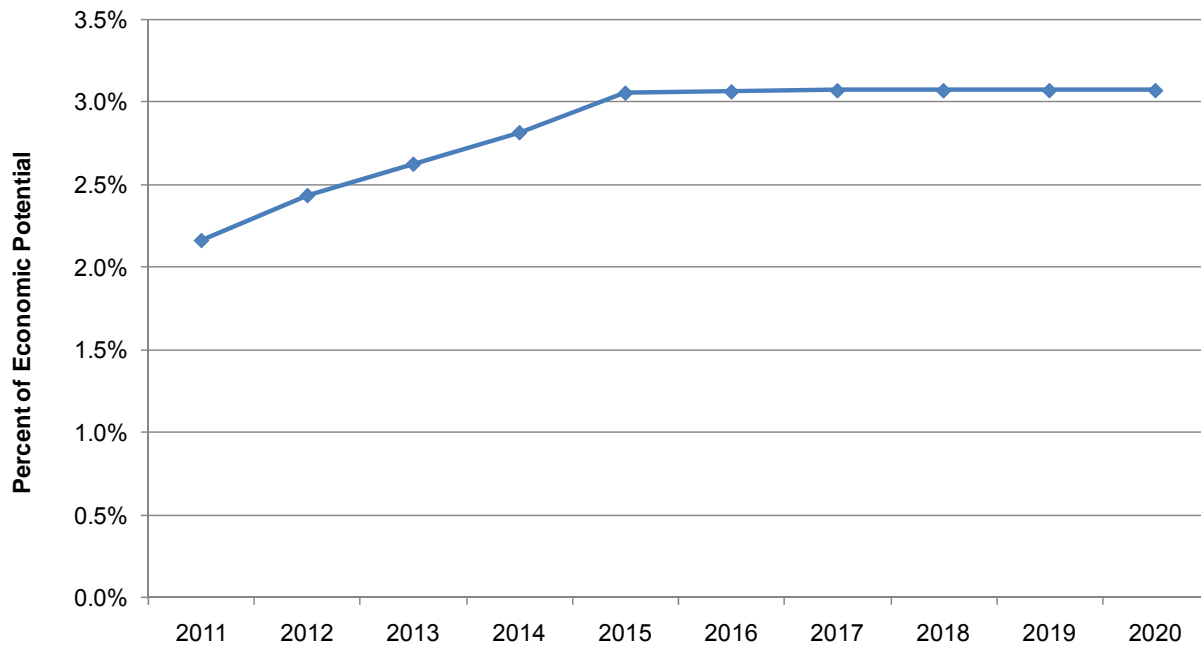


Source: Data obtained from California Energy Efficiency Resource Assessment Model (October 2010).

### Market Savings Potential and Targets

**Figure 76** shows Palo Alto's energy savings targets as a percentage of economic savings potential. Palo Alto set its 2011 targets equal to 2011 market savings potential. The utility anticipates some uncertainty about its savings potential over the coming years from changes to lighting standards and uncertainty as to whether LED lights will actually become cost-effective replacements. Due to this uncertainty in its market savings potential estimates after 2014, utility staff recommended lower future target levels to the Palo Alto City Council (which approves its goals).

**Figure 76: Target Energy Savings as a Percentage of Economic Savings Potential—Palo Alto**

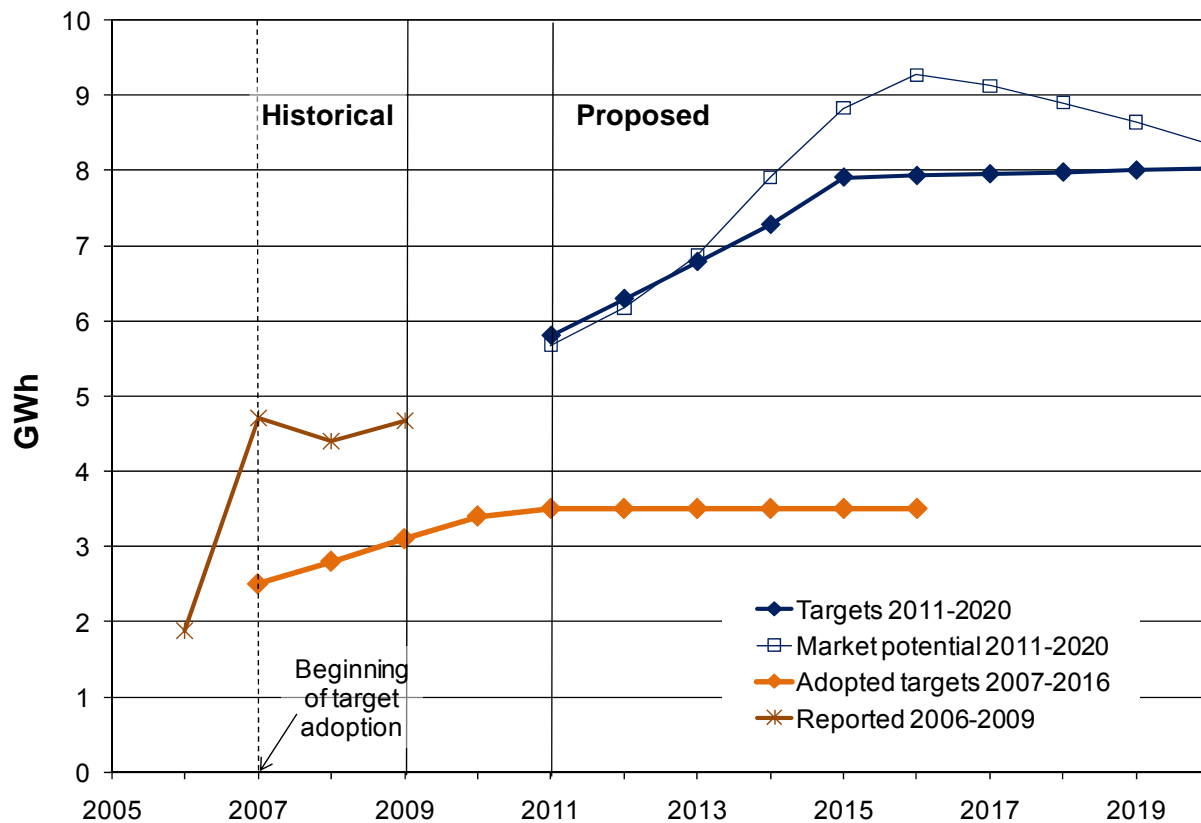


Source: Data obtained from California Municipal Utilities Association, *Energy Efficiency in California's Public Power Sector. A Status Report*, March 2010, combined with California Energy Efficiency Resource Assessment Models (October 2010).

**Figure 77** shows Palo Alto's new targets for 2011 to 2020 as compared with previous targets, past program savings, and recent estimates of market savings potential. Palo Alto's new targets are notably higher than even targets set as recently as 2011, and they climb moderately from 2012 to 2015. The revised targets are also higher than 2009 reported savings and require continuous expansion of Palo Alto's programs.

The ramp-up rate of for Palo Alto's targets is moderate, with annualized growth of nearly 8.1 percent between 2011 and 2015.

**Figure 77: Palo Alto's Historical Annual Energy Efficiency Program Savings and Targets**



Source: Data for 2011-2020 targets obtained from California Municipal Utilities Association, *Energy Efficiency in California's Public Power Sector. A Status Report*, March 2010. Data for 2011-2020 market potential obtained from California Energy Efficiency Resource Assessment Models (October 2010). Data for 2009 reported savings obtained from California Municipal Utilities Association, *Energy Efficiency in California's Public Power Sector. A Status Report*, March 2009. Data for 2007-2016 targets obtained from California Municipal Utilities Association, *Establishing Energy Efficiency Targets: A Public Power Response to AB2021. Final Update*. October 2007.

Palo Alto's 2011-2020 targets are close to market savings potential for 2011 to 2013 but lower than estimated market savings potential after 2014.

The revised targets are higher than 2007 to 2009 reported savings and require continuous ramp-up of Palo Alto's efficiency programs.

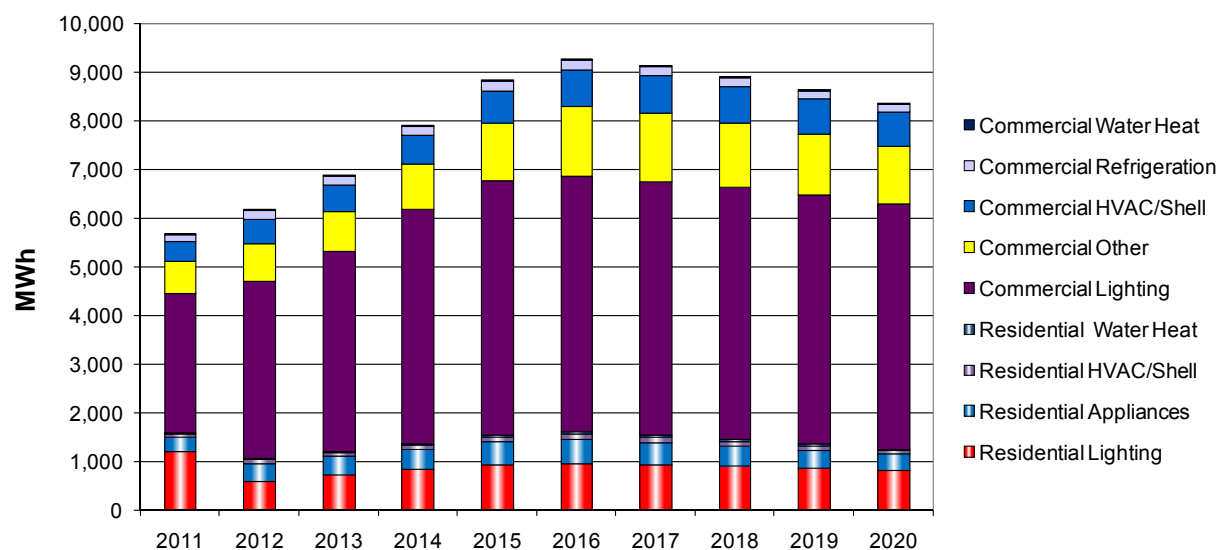
Declines in potentials for offices and multifamily dwellings primarily drive the decline in market savings potential after 2016. Awareness for most nonresidential measures reaches 100 percent by 2015. Awareness for most residential measures reaches that point by 2016. Without that increasing awareness, the decline in potential participants drives savings. (The more customers who adopt high-efficiency measures, the smaller the pool of potential participants.)

Palo Alto met its targets in 2007, 2008, and 2009. This success indicates that Palo Alto has expanded its programs to meet its historical goals. Palo Alto will need to expand further to meet the revised targets.

## Market Savings Potential by End Use

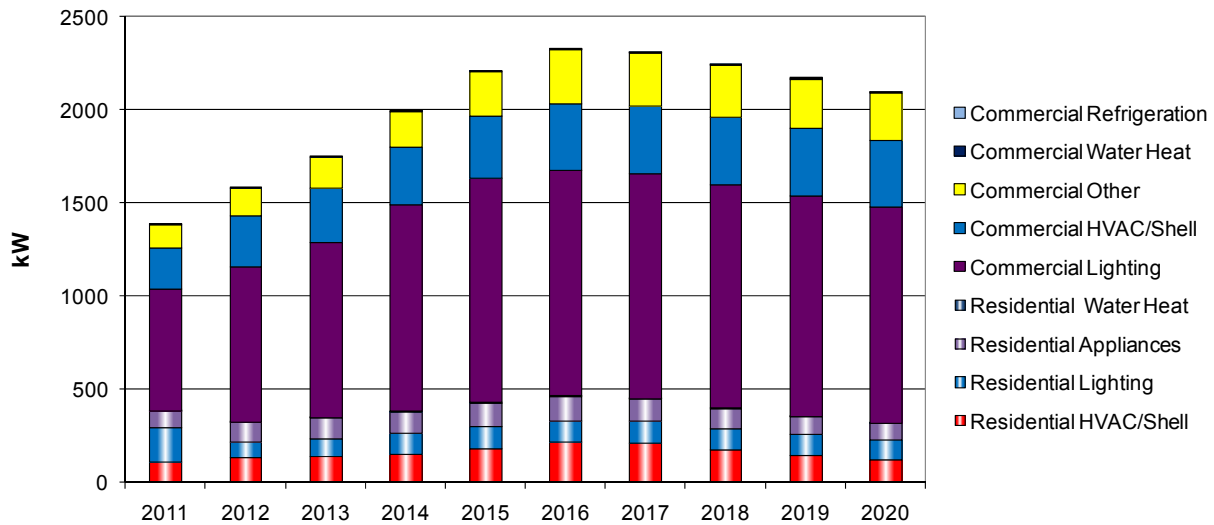
KEMA used revised 2010 CalEERAM data to break down market savings potential to show opportunities for specific programs by both customer sector and end-use category. **Figure 78** and **Figure 79** show market energy and peak demand savings potential, respectively, by sector and end use. Commercial lighting is the largest contributor to market energy savings potential. Commercial lighting, commercial HVAC, and commercial “other” are the most significant contributors to market peak demand savings potential.

**Figure 78: Palo Alto’s Market Savings Potential (MWh) by End Use**



Source: Data obtained from California Energy Efficiency Resource Assessment Model (October 2010).

**Figure 79: Palo Alto's Market Savings Potential (kW) by End Use**



Source: Data obtained from California Energy Efficiency Resource Assessment Model (October 2010).

### Program Factors Affecting Target Feasibility and Reliability

Palo Alto can meet its targets only with a realistic vision and credible implementation plan.

Palo Alto's 10-year efficiency plan is developed and updated every 3 years. To achieve this plan, the utility completes annual requests for proposals to find and contract with new vendors for programs. Management develops budgets each year. For the budget year beginning in July, management begins developing and reviewing the budget between December and March. The finance committee and city council must review and approve funding.

Eight full-time employees work in the utility's marketing services department. Two additional employees job share, and there are two part-timers, for a total of 12 people. Three full-time employees work on electric energy efficiency and low-income tasks, and one works on both natural gas energy efficiency and low-income tasks.

Palo Alto must request and approve additional staffing in the city budget. Palo Alto reports that it is extremely difficult to gain approval for additional staff. Due to this difficulty, the utility uses third-party programs whenever possible to achieve its targets.

Barriers to meeting targets on the utility side include budgets and staffing. On the customer side, there are a significant number of economic barriers, particularly for residential and small commercial customers.

Palo Alto changes individual programs annually as circumstances change and it receives new program proposals. The utility also expects to make changes to programs as new technologies become cost-effective and based on community feedback. Palo Alto also expects to add new third-party efficiency programs.

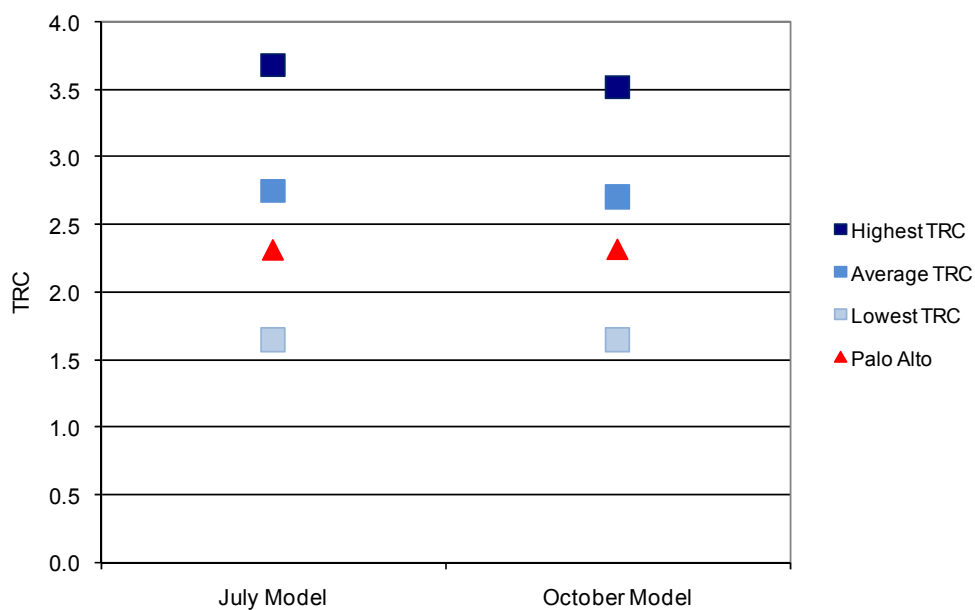
Palo Alto offers rebates for very few CFLs, primarily for niche (like flood lights) or low-income purposes. The utility expects that upcoming federal standards will have only a small effect on its residential program. On the business side, Palo Alto continues to look for process and HVAC-related savings opportunities to offset any effect from code and standards updates. Palo Alto will continue its rebates for higher technology T8 upgrades in the near term, and expects to add LED lighting as it become cost-effective. Lighting standards have less effect on business programs than on residential programs.

## Program Cost-Effectiveness

Palo Alto's fiscal year 2008/2009 programs had a TRC ratio of 2.45 (CMUA 2010, Table 7). The July version of CalEERAM shows a 2.31 TRC ratio, while October shows 2.32. **Figure 80** shows the two TRC ratios for Palo Alto compared with the other utilities. Palo Alto's TRC ratio is lower than average.

Palo Alto's first-year kWh savings cost was 86 cents for residential and 39 cents for nonresidential in 2015, compared with an average of 58 cents for residential and 36 cents for nonresidential across the POU models. Palo Alto's residential cost per first-year kWh is the highest of all 12 utilities in the detailed study.

**Figure 80: Palo Alto's TRC Ratios From Two Versions of CalEERAM, Compared to Other POU's**

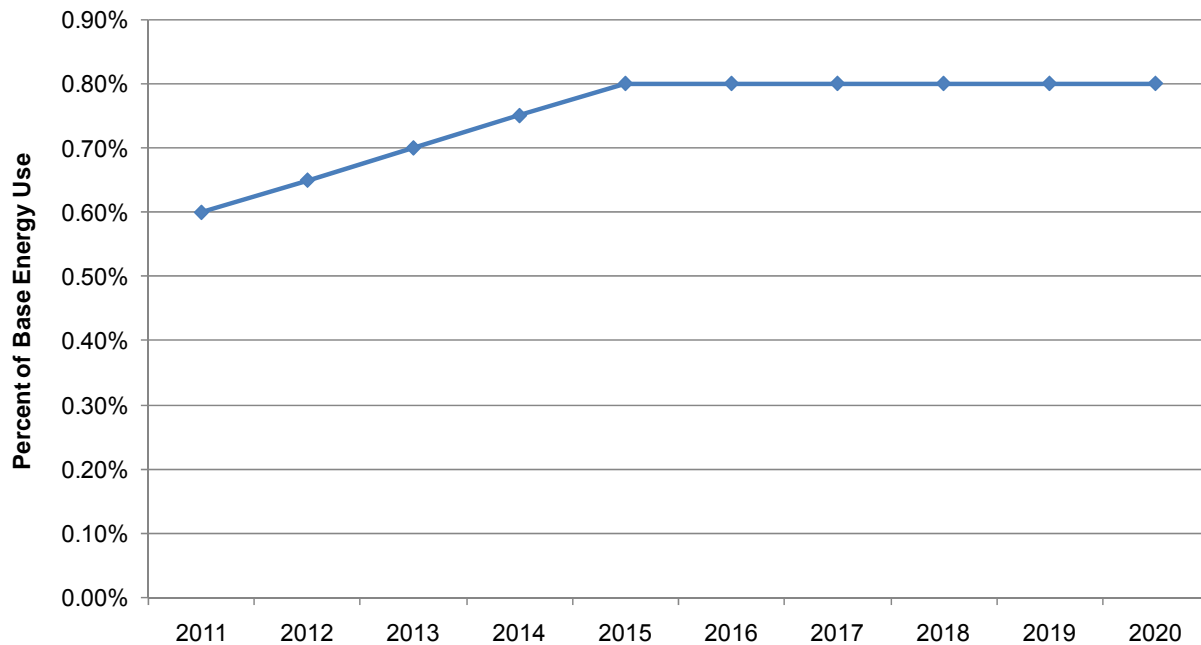


Source: Data obtained from California Energy Efficiency Resource Assessment Model (October 2010) and (July 2010) versions.

## Targets' Contribution to Energy Use Reduction

**Figure 81** shows target energy savings as a percentage of total energy use. Cumulatively, the targets add up to 7.4 percent of forecasted energy use for 2020 (based on the energy use forecast in the CalEERAM model), which fall short of the AB 2021 10 percent reduction requirement.

**Figure 81: Target Energy Savings as a Percentage of Base Energy Use—Palo Alto**



Source: Data obtained from California Municipal Utilities Association, *Energy Efficiency in California's Public Power Sector. A Status Report*, March 2010.

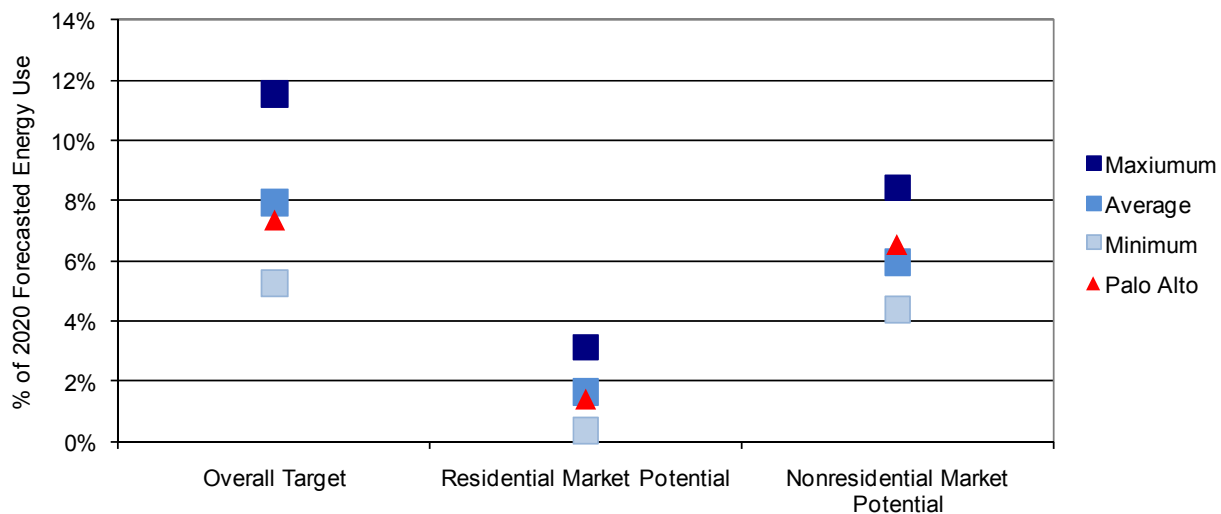
## Assessment of Targets

In this section, KEMA evaluates Palo Alto's targets by first comparing them with the other 11 POUs, then evaluating whether they are "adequate" according to AB 2021 criteria (cost-effectiveness, feasibility, reliability, and energy use reduction).

**Figure 82** shows the sum of Palo Alto's 2011-2020 targets as a percentage of energy use, compared to those of other POUs. The overall target is from the March 2010 CMUA report and represents Palo Alto's current commitments. Because the CMUA report did not break out targets by sector, **Figure 82** shows the sector breakdowns of market savings potentials from the October 2010 CalEERAM revision.

Palo Alto's target is slightly below average for the 12 utilities in the detailed study. Palo Alto's residential market savings potential is slightly below average, and its nonresidential savings potential is slightly above average.

**Figure 82: Comparison of Palo Alto's Targets With the Largest POUs**



Source: Data obtained from California Municipal Utilities Association, *Energy Efficiency in California's Public Power Sector. A Status Report*, March 2010, combined with California Energy Efficiency Resource Assessment Models (October 2010).

### *Summary of Target Adequacy*

In this section KEMA examines adopted targets across all four AB 2021 target assessment criteria. **Table 22** summarizes the findings. Palo Alto's targets meet all of the criteria. Palo Alto's targets represent a steady increase in savings from 2008 to 2015.

**Table 22: Target Assessment—Palo Alto**

Target Criterion	Criteria Description	How Well Does It Meet This Criterion?
Cost-Effectiveness	TRC ratio $\geq 1$	TRC ratio = 2.32
Feasibility	<ul style="list-style-type: none"> <li>Revised targets are reasonably related to reported savings (2006-2009)?</li> <li>Revised targets are reasonably related to market savings potential?</li> <li>Annual ramp-up rate in future years is reasonable?</li> <li>Budget and staffing is likely to be in place to achieve targets?</li> </ul>	<p>Targets represent a ramp-up from 2008-2009 reported savings.</p> <p>Targets are lower than estimated market savings potential.</p> <p>Ramp-up 2012-2015 is moderate and achievable with appropriate budget and staffing.</p> <p>Additional budget and staffing may be required to meet targets.</p>
Reliability	<ul style="list-style-type: none"> <li>Successfully achieved 2007 targets in most years?</li> <li>Utility performs regular EM&amp;V?</li> </ul>	<p>Palo Alto met its targets in 2007, 2008, and 2009.</p> <p>Palo Alto completed third party EM&amp;V impact studies of its 2008 and 2009 programs.</p>
Energy Use Reduction	<ul style="list-style-type: none"> <li>Meets 10% reduction over 10 years?</li> </ul>	Current targets reach 7.4% of base use over 10 years

### Options for Increasing Efficiency

KEMA altered the inputs to Palo Alto's model to see what changes would be required for the market savings potential to meet the AB 2021 10-year energy use reduction requirement. KEMA applied the cost-effectiveness rule (TRC ratio  $\geq 1$ ) to all measures to determine whether they would be included in the analysis. KEMA then increased Palo Alto's incentive levels incrementally until market savings potential achieved 10 percent over 10 years. Setting incentives at 63 percent of incremental measure cost produced a 10 percent cumulative savings over 10 years, with an overall TRC ratio of 2.33 and a 2011 cost of 46 cents per first-year kWh (increasing to 73 cents per kWh by 2020). By comparison, Palo Alto's existing program has an overall TRC ratio of 2.45 and costs about 38 cents per kWh in fiscal year 2008/2009.<sup>42</sup>

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<sup>42</sup> Calculated from program data in CMUA (2010), Table 7.

## **Pasadena**

### **Summary of Revised Targets**

Efficiency savings for Pasadena Water & Power (Pasadena) in fiscal year 2008/2009 represented 4.7 percent of all POU (including SMUD and LADWP) energy efficiency savings (CMUA 2010). Pasadena's 2007 targets represented only a slight increase over its 2006 program savings. Although its savings did not meet its target in 2007 and 2008, Pasadena met its 2007 targets in 2009 by a wide margin. Pasadena's new targets are lower than its previous targets for 2011 to 2016. The targets adopted in 2010 follow a stair-step pattern, increasing in 2014. The revised targets are lower than Pasadena's 2009 reported savings. The targets are roughly consistent with estimated market savings potential, but the utility's market savings potential may be overstated. The total of the program savings targets from 2011 to 2020 is equivalent to 11.5 percent of forecasted electricity use for 2020.

### **Key Analytical Differences From Other Utilities**

Pasadena was one of four utilities to set targets different from its estimated market savings potential. It adopted stair-stepped targets that were higher than market savings potential in early years and lower in later years. The cumulative target was very close to the utility's cumulative market savings potential.

Pasadena was one of five utilities where neither of its models agreed with the market savings potentials published in CMUA's March 2010 report. The market savings potentials in the model received from Pasadena in July were 10 percent higher than those reported in CMUA (2010), and the October results were similar to the July model version. Without a copy of the model that was used to estimate the published market savings potentials and targets, KEMA cannot fully explain Pasadena's results.

Pasadena was one of five POUs studied to set targets different from the market savings potentials published in the CMUA March 2010 report.

KEMA identified two possible errors in Pasadena's CalEERAM model. First, KEMA suspected that Pasadena's model used incorrect residential rates upon noting that Palo Alto and Pasadena used the same residential rates. A review of the rate schedules on the utilities' respective websites suggested that the rates in Palo Alto's model were probably correct while Pasadena's were probably too high. Pasadena confirmed this in an interview with Energy Commission staff.

Second, KEMA believes there may be an error in Pasadena's office inputs, which caused overstatement of their energy saving potential. Based on the values entered into the model on office floor space (in square feet), nonresidential energy use (kWh) and the energy share use of offices, KEMA calculated office energy intensity (kWh per square foot) for Pasadena and compared it with the nearby POUs Burbank, Glendale, and Anaheim. Pasadena's office energy

intensity was about 6 kWh per square foot compared with 15 to 16 kWh per square foot for the other three utilities. KEMA also consulted the *California Commercial End-Use Survey* (California Energy Commission 2006), which found energy intensities of 13.25 for small offices and 17.91 for large offices in the investor-owned utility Southern California Edison's service territory. This data suggests that the problem may be a too-high value for office building square footage in Pasadena. Because technology densities are expressed in units per square foot, overstating a utility's floor space would cause overall office potential estimates (technical, economic and market) to be too high.

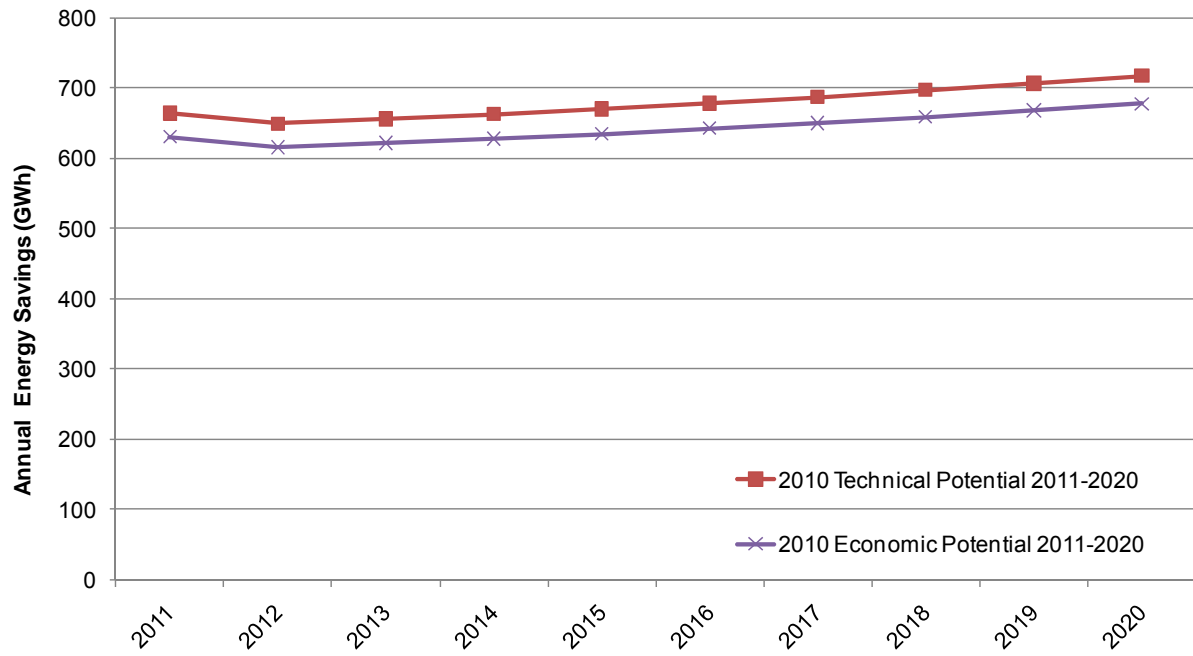
Pasadena explicitly excluded one measure from its analysis: package system A/C ( $\geq 63.3$  tons, 10.2 EER) for miscellaneous commercial buildings.

### Technical and Economic Savings Potential

**Figure 83** (energy) and **Figure 84** (demand) show Pasadena's technical and economic savings potential, as developed in its October 2010 revised CalEERAM model. Savings dip slightly in 2012 due to new federal lighting standards that will improve the efficiency of baseline lighting and reduce the savings potential for CFLs. Savings then begin climbing through the end of the forecast, averaging 1.3 growth percent per year.

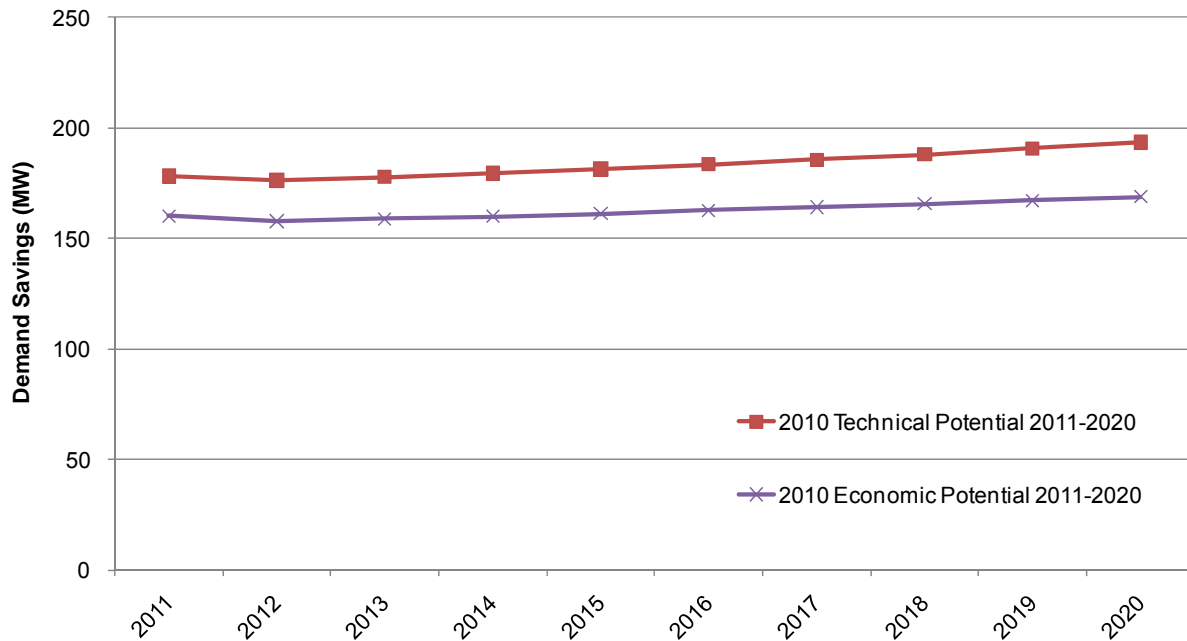
Pasadena's technical and economic savings potentials, with an estimated technical savings potential of more than 50 percent, were very high compared with POUs with similar climates and customer mixes. This observation led to KEMA's discovery that Pasadena may have overstated its savings potential for offices, as discussed in the previous section. If this is indeed the case, then all the model's potentials estimates are overstated. KEMA adjusted Pasadena's office floor space values (one possible source of the problem) to be consistent with expected energy intensity, then compared the resulting technical savings potential with the October model version. Technical savings potential dropped by 473,000 MWh in 2011, a 29 percent decrease (from 53 percent of energy use down to 38 percent of energy use).

**Figure 83: Technical and Economical Energy Savings Potential (MWh)—Pasadena**



Source: Data obtained from California Energy Efficiency Resource Assessment Model (October 2010).

**Figure 84: Technical and Economic Demand Savings Potential (MW)—Pasadena**



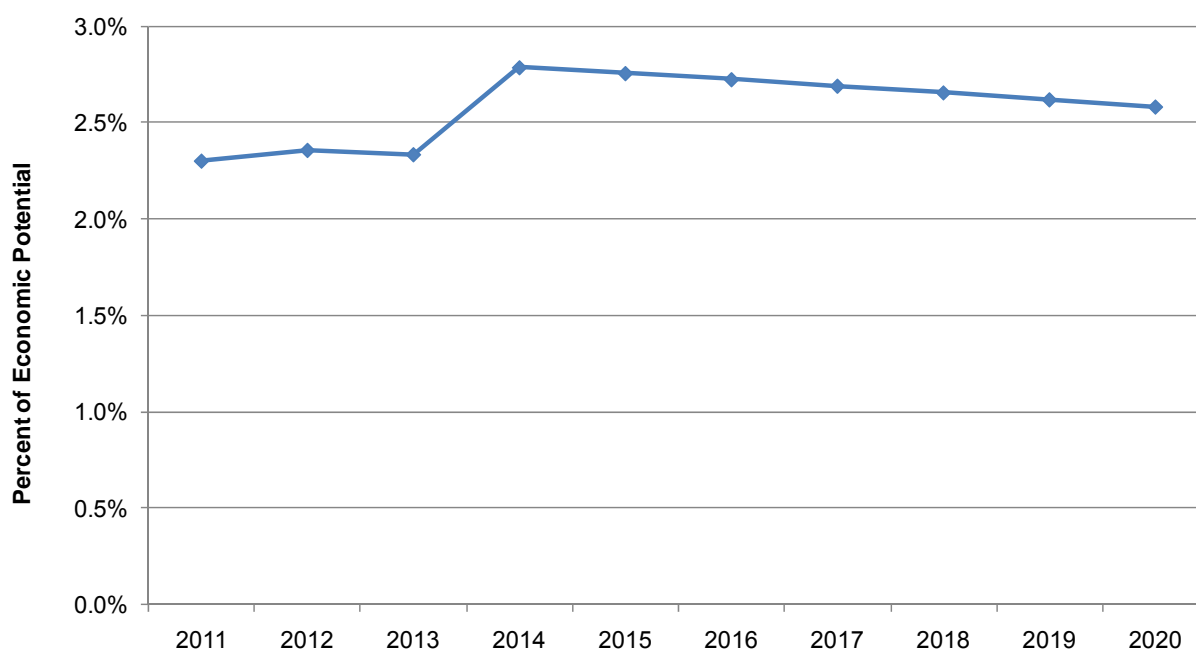
Source: Data obtained from California Energy Efficiency Resource Assessment Model (October 2010).

### Market Savings Potential and Targets

**Figure 85** shows Pasadena’s energy savings targets as a percentage of economic savings potential. Pasadena’s targets are stair stepped: 14,500 MWh per year from 2011 to 2013 and 17,500 thereafter. Because economic savings potential is growing over most of the period, these targets represent a declining share of economic savings potential from 2014 to 2020.

Pasadena staff indicated that the average market savings potential for this period was the basis for the adopted target for each of the first three years ; similarly, the period’s average of market savings potential was the basis of the adopted annual target for each year from 2014-2020. Pasadena rounded up both targets for simplicity. Pasadena chose to smooth out the variations in its market savings potential and present two simple targets for the community’s consideration. Higher targets after the first three fiscal years assume that a Pasadena will adopt a future rate increase.

**Figure 85: Target Energy Savings as a Percentage of Economic Savings Potential—Pasadena**



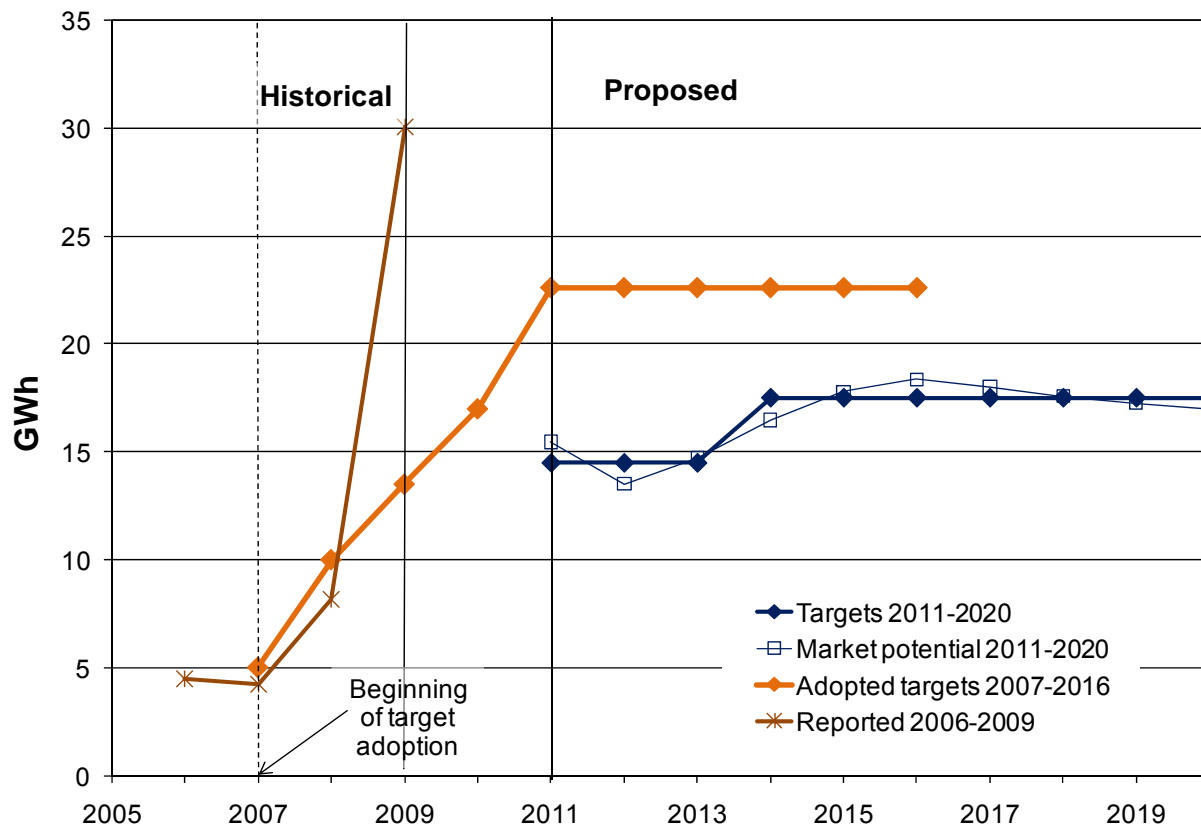
Source: Data obtained from California Municipal Utilities Association, *Energy Efficiency in California's Public Power Sector. A Status Report*, March 2010, combined with California Energy Efficiency Resource Assessment Models (October 2010).

**Figure 86** shows Pasadena's new targets for 2011 to 2020 as compared with its previous targets, past program savings, and recent market savings potential estimates. Pasadena's 2007 targets increased through 2011, then flattened out. The revised targets are slightly higher than the 2009 target (set in 2007), but lower than previous targets for 2011 to 2016.

The 2010 targets also represent a step down from 2009 savings. Both the previous 2009 target and the new 2011 target are less than half of Pasadena's reported 2009 savings.

Pasadena's targets step up 21 percent between 2013 and 2014. While this is a large annual increase, it is likely that programs will actually be ramped up more gradually. Spread over a few years, the ramp-up would be modest.

**Figure 86: Pasadena's Historical Annual Energy Efficiency Program Savings and Targets**



Source: Data for 2011-2020 targets obtained from California Municipal Utilities Association, *Energy Efficiency in California's Public Power Sector. A Status Report*, March 2010. Data for 2011-2020 market potential obtained from California Energy Efficiency Resource Assessment Models (October 2010). Data for 2009 reported savings obtained from California Municipal Utilities Association, *Energy Efficiency in California's Public Power Sector. A Status Report*, March 2009. Data for 2007-2016 targets obtained from California Municipal Utilities Association, *Establishing Energy Efficiency Targets: A Public Power Response to AB2021. Final Update*, October 2007.

Pasadena's market savings potential is high compared with most of the other 12 POUs. (See **Figure 21**.) This directly relates to Pasadena's high technical and economic savings potential, which KEMA believes Pasadena overestimated because of a data error. The magnitude of the error appears to be smaller for market savings potential than for either technical or economic savings potential. When KEMA adjusted Pasadena's office floor space values (one possible source of the problem) so that they would be consistent with expected energy intensity, the utility's market savings potential dropped by about 6 percent.

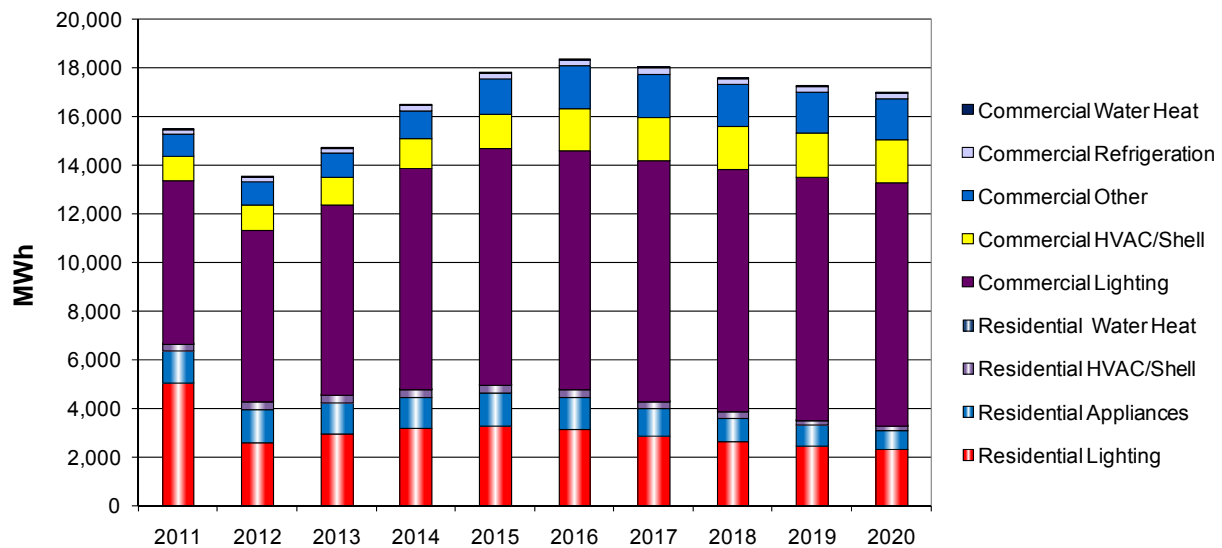
Pasadena's 2011-2020 targets are lower than its market savings potential in some years and higher in others, but are still cumulatively very close. If market savings potential is indeed overstated, as KEMA believes, then the 2010 targets are high relative to true market savings potential, which may make it difficult for Pasadena to meet its targets in the long run.

Pasadena's historical savings paint a different picture. Pasadena fell slightly short of its targets in 2007 and 2008 but beat its 2009 targets by more than a factor of two. The revised targets for 2011 and beyond are lower than 2009 reported savings, suggesting that Pasadena should meet or exceed its targets and could perhaps even establish ones that are more aggressive.

## Market Savings Potential by End Use

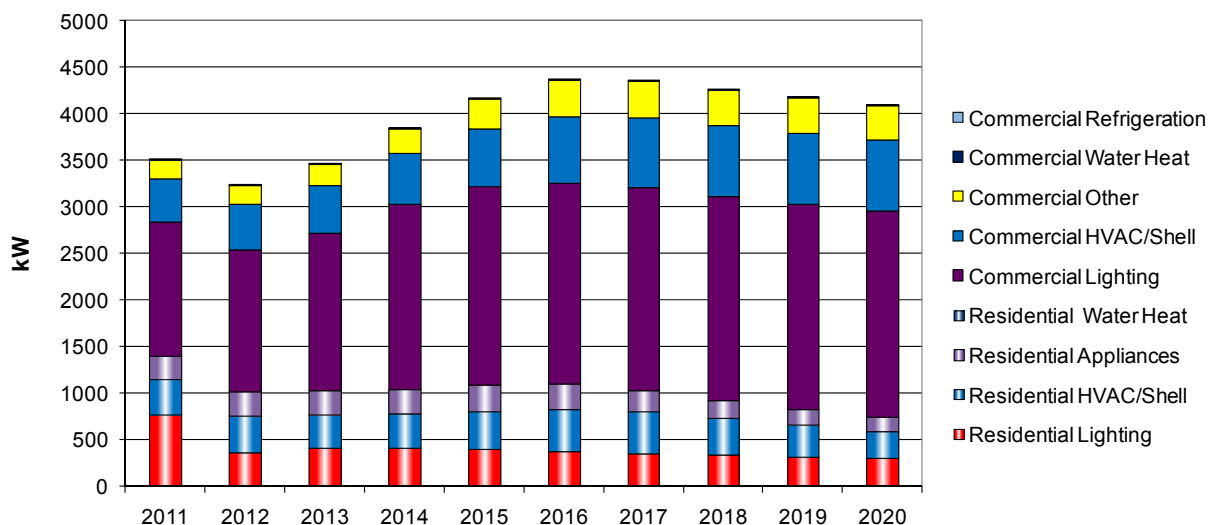
KEMA used revised 2010 CalEERAM data to disaggregate market savings potential to show opportunities for specific programs by both customer sector and end-use category. **Figure 87** and **Figure 88** show market energy and peak demand savings potential, respectively, by sector and end use. Commercial lighting is the largest contributor to market energy savings potential. Commercial lighting and commercial HVAC are the most significant contributors to market peak demand savings potential.

**Figure 87: Pasadena's Market Savings Potential (MWh) by End Use**



Source: Data obtained from California Energy Efficiency Resource Assessment Model (October 2010).

**Figure 88: Pasadena's Market Savings Potential (kW) by End Use**



Source: Data obtained from California Energy Efficiency Resource Assessment Model (October 2010).

### Program Factors Affecting Target Feasibility and Reliability

The Pasadena City Council adopts Pasadena's budgets annually. Pasadena submits budget requests in November for the coming fiscal year, and the city council approves them the following June. Individual program funding targets may change throughout the year based on customer participation. (Pasadena can shift funding levels to more cost-effective programs when demand increases.)

Securing additional funding requires a rate increase, which must be justified and approved through a series of public meetings, followed by the city council's approval.

Six full time employees staff Pasadena's efficiency programs: one management analyst serving as administrator, two account managers as program managers, and three as staff support. An additional six staff members charge part of their time to programs, and four community centers provide outreach, program intake, and the distribution of efficiency products. Pasadena has two local contractors and one nonprofit position for field support and equipment verifications, in addition to three vendors contracted by the Southern California Public Power Authority. Half of the team has been working together for 12 years, the other half for 5 years. Pasadena staff felt it would be difficult, with its existing staff, to reach higher targets as the utility works with more small customers in the future.

The economic recession is a key program barrier. Customers are still reluctant either to make investments or support rate increases. Retail energy use and revenue from electricity sales have decreased over the last two years. Competition between fund categories and earlier project commitments are also straining the public benefits fund.

Pasadena expects to keep offering its incentives, based upon its existing fiscal year 2011 budget. The utility recently enhanced its lighting rebates for nonresidential customers and expects to both offer home energy reports to its customers and begin a small business direct install program. In the near term, Pasadena will eliminate its least cost-effective programs and shift its resources to programs with low first-year costs that also meet program targets without raising rates. Incentives will be adjusted where needed based on several factors, including measure saturation.

Introducing new programs can take up to two years from concept and development to public introduction. During that time a utility must create a database to track activity, contract with vendors, create forms and marketing materials, and perform many other pre-implementation tasks and duties.

Pasadena staff expects that codes and standards changes will make it difficult to achieve its goals. The utility determines its actual programs savings by comparing incentivized behavior to baseline code requirements; more stringent code requirements will reduce the energy efficiency effect of utility-sponsored projects, even though impacts to the electric grid may be substantially greater.

Pasadena is evaluating the effects of 2008 Title 24 energy and 2011 Title 24 CalGREEN codes on its nonresidential programs. The City of Pasadena adopted a more stringent code for existing building alterations than the state requires. Estimating the full effects of the new codes on lighting is very difficult because a variety of circumstances may or may not trigger the more stringent codes.

Pasadena is also developing a scope of work and negotiating with a vendor to evaluate non-residential and low-income programs. The utility is additionally working with a consultant on a process to evaluate its nonresidential programs.

### Program Cost-Effectiveness

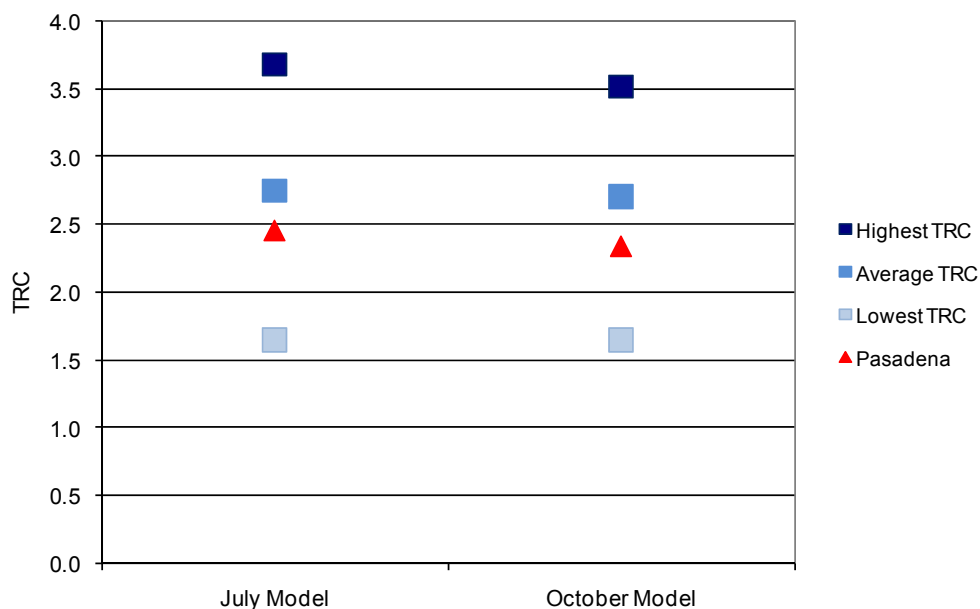
Pasadena's fiscal year 2008/2009 programs had a TRC ratio of 2.68 (CMUA 2010, Table 7).

Neither available version of the CalEERAM model matches the savings potentials presented in the CMUA March 2010 report, so the cost-effectiveness of the targets is not available. The July version of the CalEERAM model shows a TRC ratio of 2.45 for estimated market savings potential, with a TRC ratio of 2.32 in the October revision. **Figure 89** shows the two TRC ratios for Pasadena, as compared to all 12 POUs. Pasadena's TRC ratio is below average. Because Pasadena's targets are fairly close to the estimated market savings potentials, these TRC ratios should be close to their targets.

The cost per first-year kWh of savings from Pasadena's model was 49 cents for residential and 38 cents for nonresidential in 2015, compared with an average of 58 cents for residential and 36 cents for nonresidential across the other POU models. Pasadena's residential cost is the second

lowest of the 12 utilities in the detailed study, and its nonresidential cost is slightly above average.

**Figure 89: Pasadena's TRC Ratios From Two CalEERAM Versions, Compared to Other POUs**

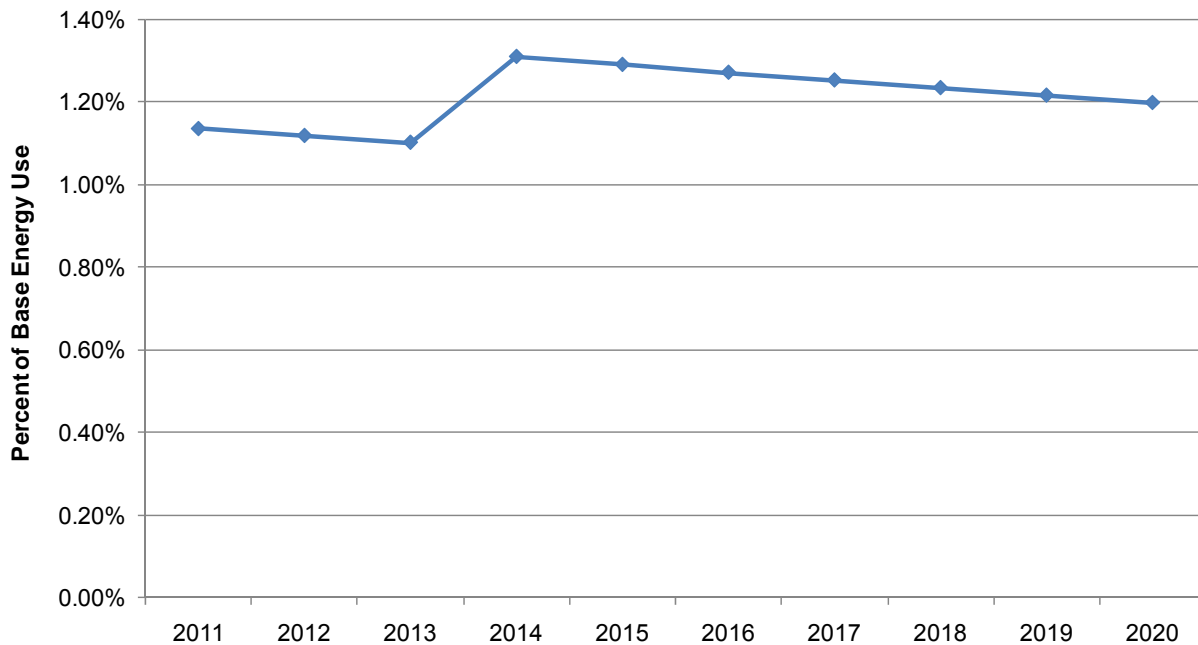


Source: Data obtained from California Energy Efficiency Resource Assessment Model (October 2010) and (July 2010) versions.

### Targets' Contribution to Energy Use Reduction

Pasadena will reduce its electricity use over the forecast period if it successfully meets its program targets. **Figure 90** shows target energy savings as a percentage of total energy use. Cumulatively, the targets add up to 11.5 percent of one year of energy use for 2020 (based on the energy use forecast in the CalEERAM model) and exceed AB 2021's 10 percent reduction requirement.

**Figure 90: Target Energy Savings as a Percentage of Base Energy Use—Pasadena**



Source: Data obtained from California Municipal Utilities Association, *Energy Efficiency in California's Public Power Sector. A Status Report*, March 2010.

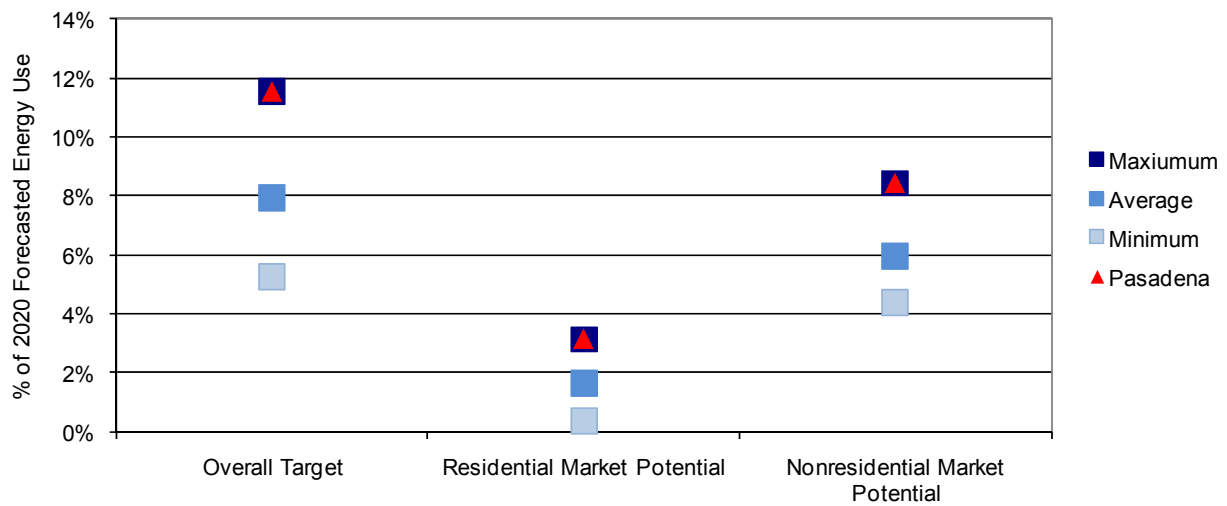
### Assessment of Targets

In this section, KEMA evaluates Pasadena's targets by comparing them with the other 11 POU's, and then evaluating whether they adequately meet the AB 2021 criteria (cost-effectiveness, feasibility, reliability, and energy use reduction).

**Figure 91** shows the sum of Pasadena's 2011-2020 targets as a percentage of energy use, relative to those of other POU's. The utility's overall target is from the March 2010 CMUA report and represents Pasadena's current commitments. Because the CMUA report did not break out targets by sector, **Figure 91** shows the sector breakdowns of market savings potentials from the October 2010 CalEERAM revision.

Pasadena's target (as a percentage of energy usage) is the highest of the 12 utilities in the detailed study. The same is true for both its residential and nonresidential market savings potentials. As noted, Pasadena may have overstated its market savings potentials. However, KEMA's effort to correct the error reduced nonresidential market savings potential to 7.6 percent of energy use (cumulative to 2020), which is still the second highest of the 12 utilities. Overall market savings potential reached 10.7 percent over 10 years in the revised model, relative to energy use in 2020.

**Figure 91: Pasadena's Targets, Compared With the 12 Largest POU's**



Source: Data obtained from California Municipal Utilities Association, *Energy Efficiency in California's Public Power Sector. A Status Report*, March 2010, combined with California Energy Efficiency Resource Assessment Models (October 2010).

### *Summary of Target Adequacy*

In this section KEMA examines the adopted targets across all four AB 2021 target assessment criteria. **Table 23** summarizes the findings. Pasadena's targets meet the energy use reduction target and cost-effectiveness goals, but not the feasibility and reliability goals. The feasibility of the goals is questionable because a model error may have caused overstatement of the potential estimates. If this is the case, the targets may be too high to be sustainable. The effect of the error on market savings potential, however, is not as large as its effect on technical and economic potential; even with corrections, cumulative market savings potential appears to surpass 10 percent over 10 years.

Pasadena did not meet its targets in 2007 and 2008. Its success in 2009 is promising, however, so the increased savings suggest that the utility made meaningful changes to its programs. Until savings data show that Pasadena has met its 2010 targets, however, its past performance does not meet the reliability criterion. Additionally, Pasadena has not yet completed third-party EM&V studies of its programs, so the accuracy of its reported savings has not been measured or verified.

**Table 23: Target Assessment—Pasadena**

Target Criterion	Criteria Description	How Well Does It Meet This Criterion?
Cost-Effectiveness	TRC ratio $\geq 1$	TRC ratio = 2.33
Feasibility	<ul style="list-style-type: none"> <li>Revised targets are reasonably related to reported savings (2006-2009)?</li> <li>Revised targets are reasonably related to market savings potential?</li> <li>Annual ramp-up rate in future years is reasonable?</li> <li>Budget and staffing is likely to be in place to achieve targets?</li> </ul>	<p>Targets are lower than 2009 reported savings.</p> <p>Targets are close to estimated market savings potential, Market potential may be overstated. KEMA's attempt to correct the model error found that cumulative market savings potentials were lower but still reached 10.7 percent of energy use over 10 years.</p> <p>Ramp-up 2012-2015 is modest.</p> <p>Based on 2009 reported savings, budget and staffing will probably adequate to meet targets.</p>
Reliability	<ul style="list-style-type: none"> <li>Successfully achieved 2007 targets in most years? Utility performs regular EM&amp;V?</li> </ul>	<p>Pasadena fell slightly short of targets in 2007 and 2008, but exceeded their 2009 target by a wide margin.</p> <p>Pasadena is in the process of performing EM&amp;V on its programs.</p>
Energy Use Reduction	<ul style="list-style-type: none"> <li>Meets 10% reduction over 10 years?</li> </ul>	Current targets reach 11.5% of 2020 forecasted energy use over 10 years.

### Options for Increasing Efficiency

Pasadena's targets already meet the AB 2021 10 percent over 10 years requirement.

KEMA reran the model to correct the suspected error in office building floor space, which decreased market savings potentials only slightly and did not affect attainment of the AB 2021 requirement.

The revised model had an overall TRC ratio of 2.32 and a 2011 cost of 31 cents per first-year kWh (increasing to 57 cents per kWh by 2020). By comparison, Pasadena's existing program has an overall TRC ratio of 2.68 and cost about 19 cents per kWh in fiscal year 2008/2009.<sup>43</sup>

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<sup>43</sup> Calculated from program data in CMUA (2010) Table 7.

## Riverside

### Summary of Revised Targets

Efficiency savings for Riverside Public Utilities (Riverside) in fiscal year 2008/2009 represented 2.5 percent of all POU (including SMUD and LADWP) energy efficiency savings (CMUA 2010). Riverside's 2007 targets represented a significant increase over its 2006 program savings, but its savings fell short of its targets in 2007, 2008, and 2009. Riverside's new targets for 2011 and 2012 are lower than targets set in 2007 and more in line with savings reported for 2009. The targets increase from 2012 to 2016, decline through 2020, and are relatively flat thereafter. The targets are close to the estimated market savings potential throughout the forecast period. The cumulative total of program savings targets from 2011 to 2020 are equivalent to 6.9 percent of forecasted electricity use for 2020.

### Key Analytical Differences From Other Utilities

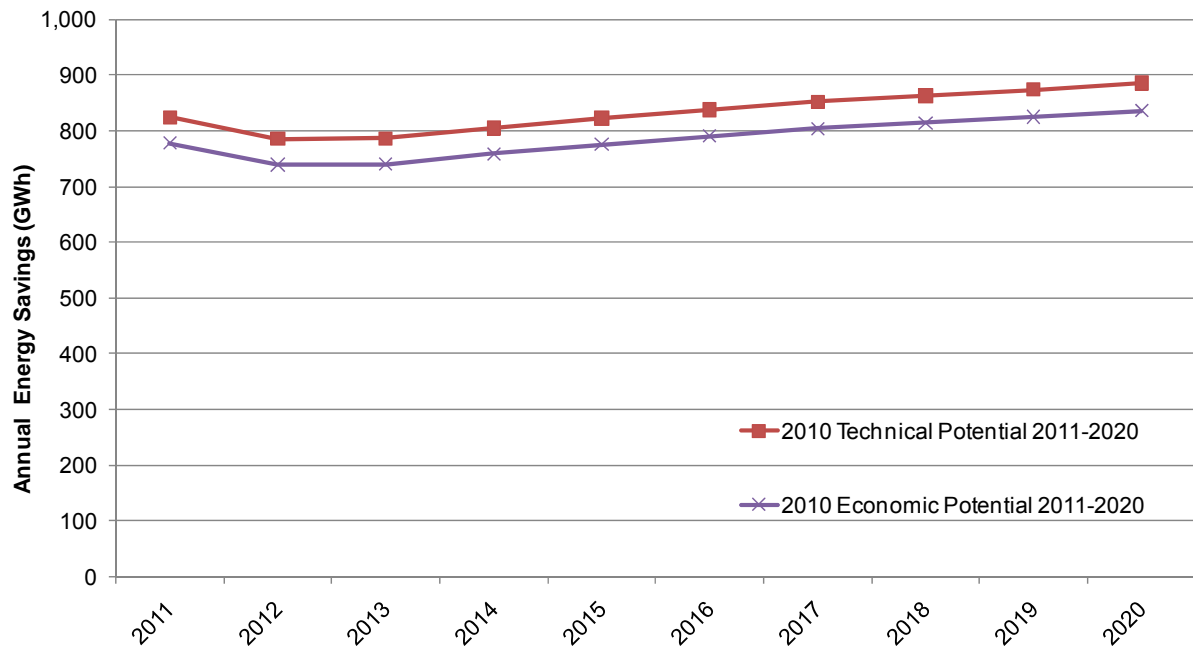
Riverside's CalEERAM model did not have any major differences from most of the other POUs.

Riverside was the only one of the 12 POUs to model chemicals as its industrial sector. Riverside was also one of only two POUs to explicitly include nonresidential demand rates in its model.

### Technical and Economic Savings Potential

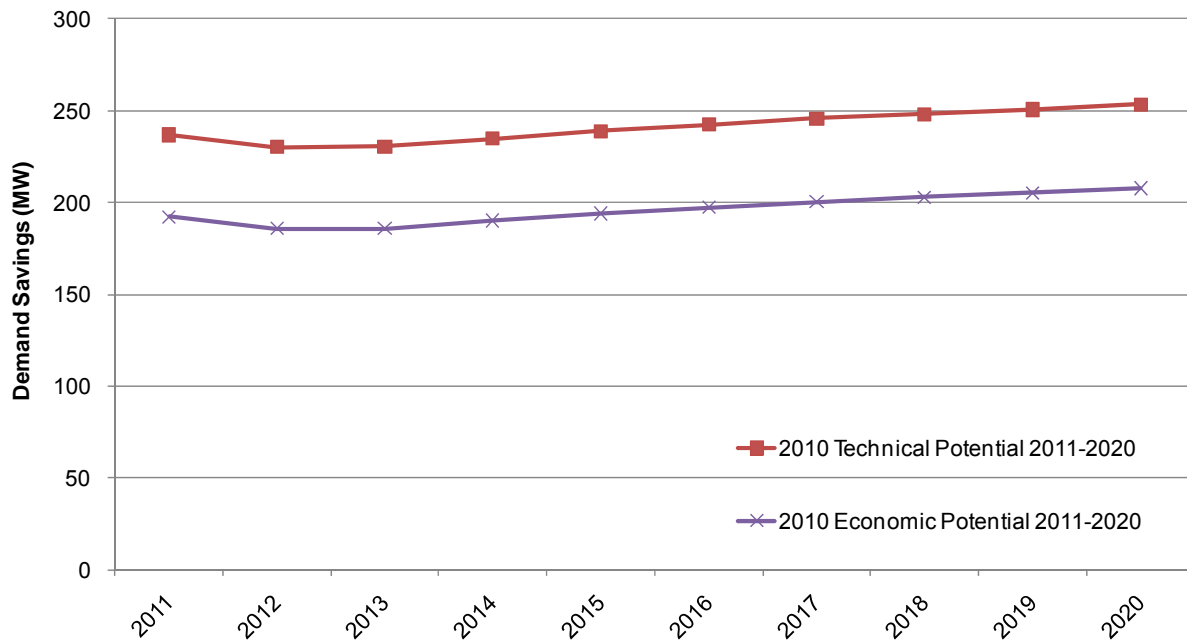
**Figure 92** (energy) and **Figure 93** (demand) show Riverside's technical and economic savings potential, as developed in its revised October 2010 model. Savings dip slightly in 2012 due to new federal lighting standards, which will improve the efficiency of baseline lighting and reduce the savings potential for CFLs. Savings then begin climbing through the end of the forecast, averaging 1.5 percent growth per year.

**Figure 92: Technical and Economical Energy Savings Potential (MWh)—Riverside**



Source: Data obtained from California Energy Efficiency Resource Assessment Model (October 2010).

**Figure 93: Technical and Economic Demand Savings Potential (MW)—Riverside**

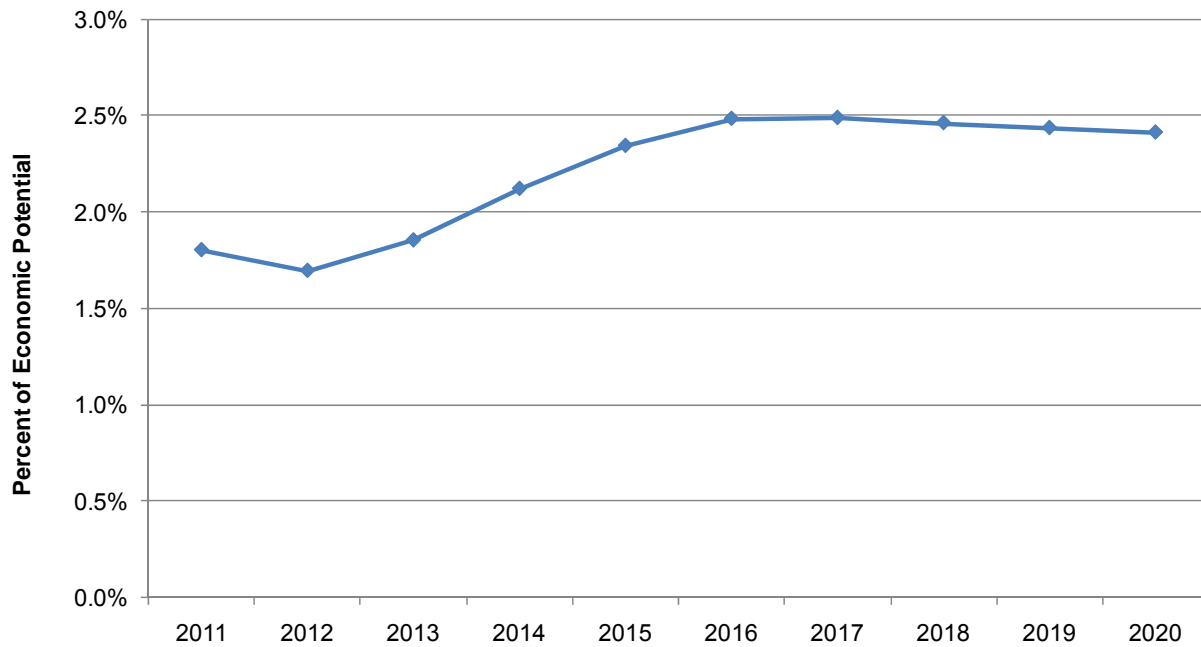


Source: Data obtained from California Energy Efficiency Resource Assessment Model (October 2010).

### Market Savings Potential and Targets

**Figure 94** shows Riverside’s energy savings targets as a percentage of economic savings potential. Riverside’s targets increase at a moderately aggressive rate from 2012 to 2016.

**Figure 94: Target Energy Savings as a Percentage of Economic Savings Potential—Riverside**

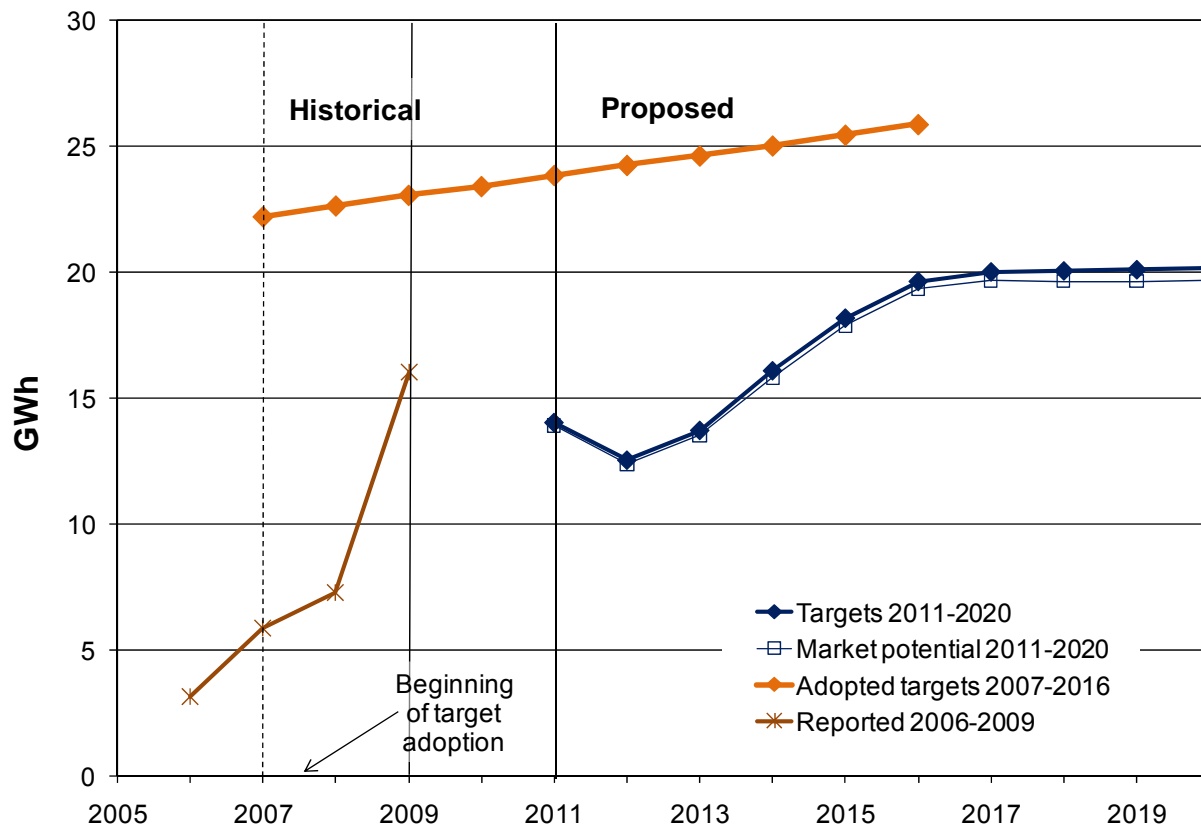


Source: Data obtained from California Municipal Utilities Association, *Energy Efficiency in California's Public Power Sector. A Status Report*, March 2010, combined with California Energy Efficiency Resource Assessment Models (October 2010).

**Figure 95** shows Riverside's new targets for 2011 to 2020 as compared with previous targets, past program savings, and recent estimates of market savings potential. Riverside's new targets are notably lower than older targets, and 2011 targets are slightly lower than 2009 reported savings. The new revised targets are notably lower than the previous targets adopted in 2007 for 2007 through 2016.

The ramp-up rate in Riverside's targets is moderately aggressive compared to other utilities and show annualized growth of almost 12 percent between 2012 and 2016.

**Figure 95: Riverside's Historical Annual Energy Efficiency Program Savings and Targets**



Source: Data for 2011-2020 targets obtained from California Municipal Utilities Association, *Energy Efficiency in California's Public Power Sector. A Status Report*, March 2010. Data for 2011-2020 market potential obtained from California Energy Efficiency Resource Assessment Models (October 2010). Data for 2009 reported savings obtained from California Municipal Utilities Association, *Energy Efficiency in California's Public Power Sector. A Status Report*, March 2009. Data for 2007-2016 targets obtained from California Municipal Utilities Association, *Establishing Energy Efficiency Targets: A Public Power Response to AB2021. Final Update*, October 2007.

Riverside's 2011-2020 targets are slightly higher than its market savings potential.<sup>44</sup> Given the margin of error in the potential estimate, KEMA does not believe that this gap will adversely affect Riverside's ability to meet its targets.

Riverside did not meet its targets in 2007 through 2009. The utility's updated targets are lower than for 2007 and are more in line with reported 2009 savings.

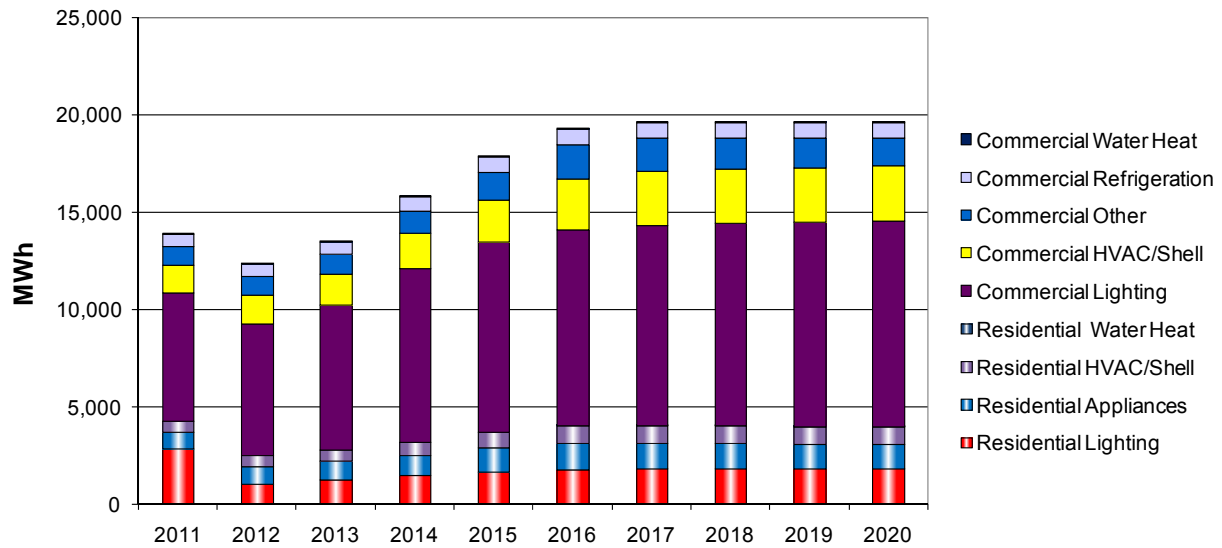
<sup>44</sup> For the March 2010 CMUA report, Riverside's targets were set the same as its market savings potential. The October model revision resulted in small changes to the market savings potential estimates.

## Market Savings Potential by End Use

KEMA used revised 2010 CalEERAM data to break out market savings potential to show opportunities for specific programs by both customer sector and end-use category. **Figure 96** and

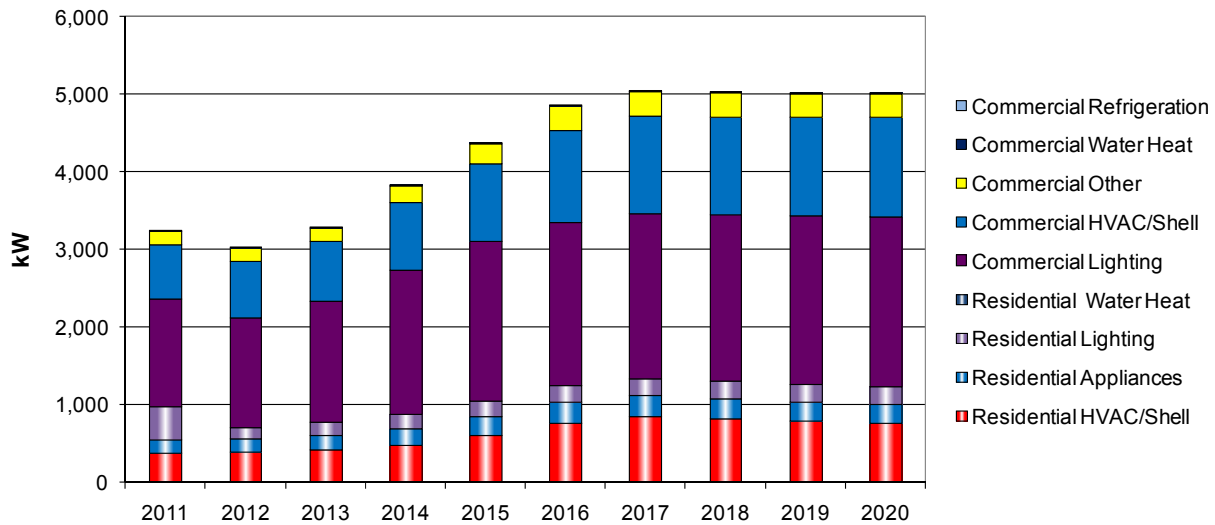
**Figure 97** show market energy and peak demand savings potential, respectively, by sector and end use. Commercial lighting is the largest contributor to market energy savings potential. Commercial lighting and commercial HVAC are the most significant contributors to market peak demand savings potential.

**Figure 96: Riverside's Market Savings Potential (MWh) by End Use**



Source: Data obtained from California Energy Efficiency Resource Assessment Model (October 2010).

**Figure 97: Riverside's Market Savings Potential (kW) by End Use**



Source: Data obtained from California Energy Efficiency Resource Assessment Model (October 2010).

### Program Factors Affecting Target Feasibility and Reliability

Riverside, like most of the 12 POUs, plans one year ahead. The planners look at the programs and budgets quarterly; the director can then make changes as needed, adding or eliminating programs or shifting funds to accommodate those changes. The utility values this flexibility and its contribution to a dynamic environment.

Riverside has a hiring freeze until 2012. If the freeze ends, the utility could possibly add one more staff member.

Riverside expects to either meet or exceed its targets. The utility spent a great amount of money marketing programs in both its residential and commercial sectors. As a result of this successful outreach, Riverside had to turn customers away when it ran out of money for rebates. In the past, the utility has distributed an average of \$6,000 to \$7,000 in rebates per year. In 2010, Riverside provided more than \$20,000 in rebates, an increase Riverside attributes to tax credits that further reduce the cost of energy-efficiency measures for the consumer.

Low customer participation is one possible barrier to meeting its targets.

Riverside staff found the CalEERAM model informative. The utility identified potential areas where it could potentially offer more energy efficiency programs, such as in the commercial sector (specifically in warehouses).

Riverside expects more direct installs in the commercial sector, specifically in commercial lighting. Program staff has found the commercial sector to be very reluctant to spend money on energy efficiency projects due to the weak economy.

The utility has made some changes to its portfolio. Riverside eliminated the residential thermostat program and reduced efforts on whole house fans and pool pumps. Riverside no longer offers rebates for screw-in CFLs, which would help mitigate the effect of upcoming federal standards on their program.

SB 1 and low-income programs accounted for about half of the public benefits charge funds. Last year, Riverside spent about \$2.1 million on low-income programs.

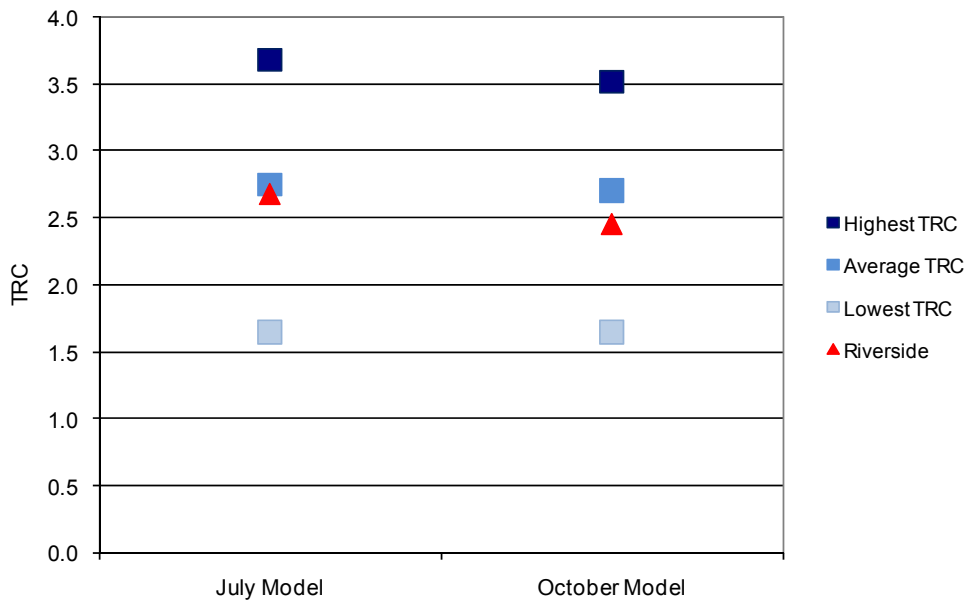
Riverside evaluates one commercial and one residential efficiency program every year. A contractor conducted Phase 1 of the EM&V studies, but Riverside will handle Phase 2 itself. Riverside and other Southern California POU are encouraging Southern California Public Power Authority's management to add more firms with engineering backgrounds to conduct future EM&V studies. The utility uses third-party contractors for some work.

### Program Cost-Effectiveness

Riverside's fiscal year 2008/2009 programs had a TRC ratio of 4.2 (CMUA 2010, Table 7). The CalEERAM model used to set the targets shows a TRC ratio of 2.68. An error in the model used to create this value increases uncertainty in the accuracy of the TRC ratio estimate, so reviewers additionally looked at the TRC ratio for the market savings potential from the revised CalEERAM, which is 2.46. **Figure 98** shows the two TRC ratios for Riverside compared with the other utilities. Riverside's TRC ratio is slightly below the average.

The cost per first-year kWh of savings from Riverside's model was 55 cents for residential and 37 cents for nonresidential in 2015, compared to an average of 58 cents for residential and 36 cents for nonresidential across all 12 POU models. Riverside's cost is slightly below average for residential and close to average for nonresidential.

**Figure 98: Riverside's TRC Ratios From Two Versions of CalEERAM, Compared to Other POU's**

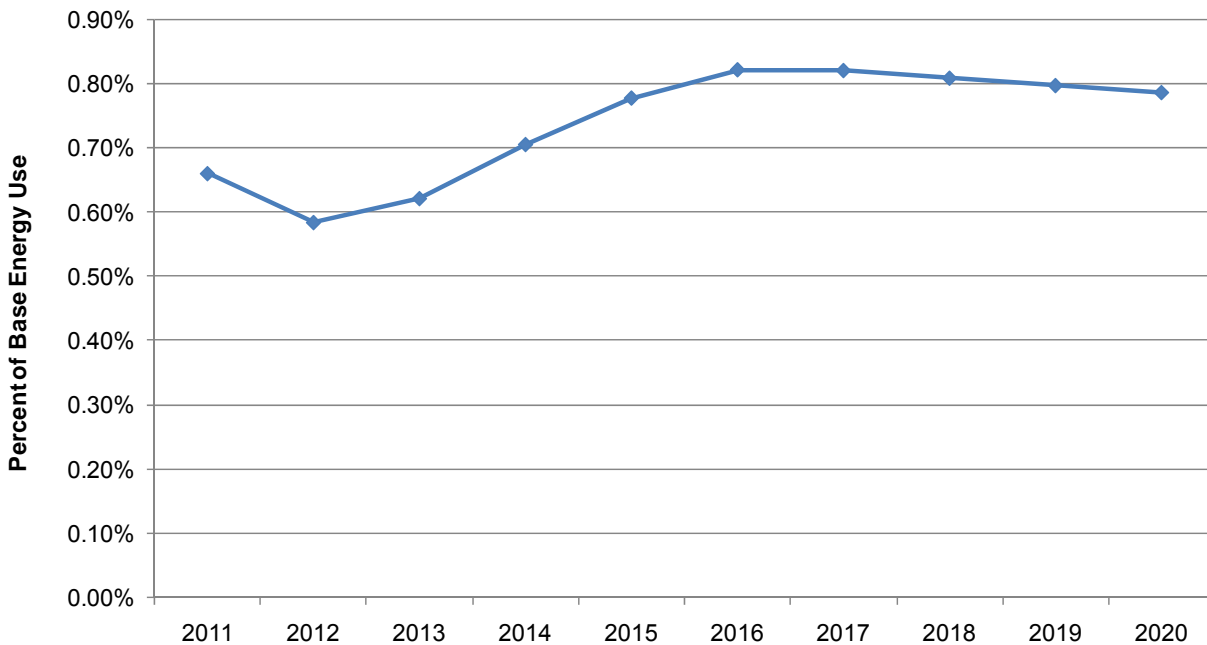


Source: Data obtained from California Energy Efficiency Resource Assessment Model (October 2010) and (July 2010) versions.

### Targets' Contribution to Energy Use Reduction

Meeting its targets through successful programs will reduce Riverside's electricity use over the forecast period. **Figure 99** shows target energy savings as a percentage of total energy use. Cumulatively, the targets add up to 6.9 percent of one year energy use for 2020 (based on the energy use forecast in the CalEERAM model) but do not meet AB 2021's 10 percent reduction requirement.

**Figure 99: Target Energy Savings as a Percentage of Base Energy Use—Riverside**



Source: Data obtained from California Municipal Utilities Association, *Energy Efficiency in California's Public Power Sector. A Status Report*, March 2010.

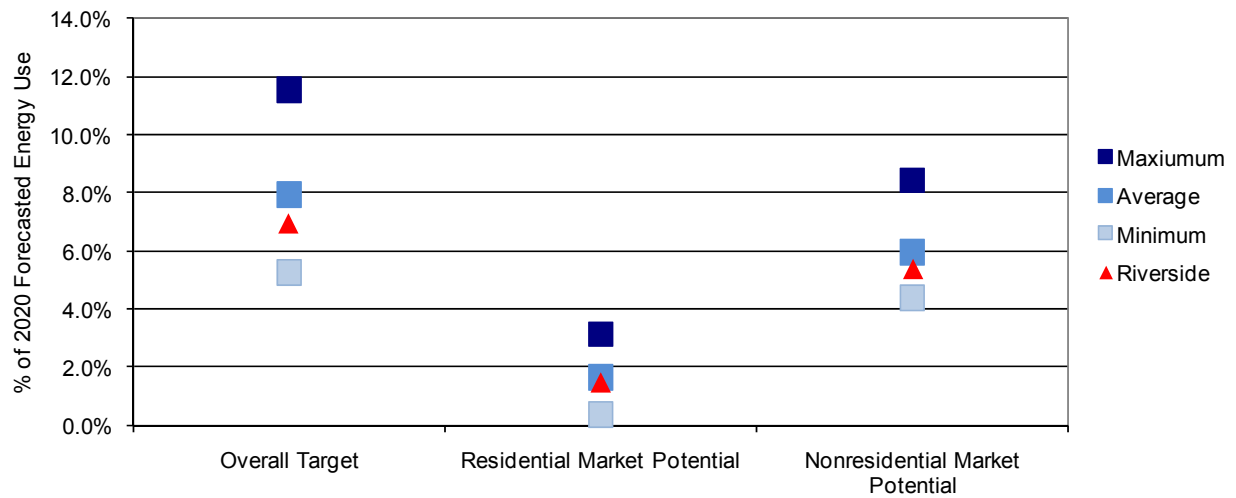
### Assessment of Targets

In this section, KEMA evaluates Riverside's targets by first comparing them with the other 11 POUs, then evaluating whether they adequately meet AB 2021's criteria (cost-effectiveness, feasibility, reliability, and energy use reduction).

**Figure 100** shows the sum of Riverside's 2011-2020 targets as a percentage of energy use, relative to those of other POUs. The overall target is from the March 2010 CMUA report and represents Riverside's current commitments. Because the CMUA report did not break out targets by sector, **Figure 100** shows the sector breakdowns of market savings potentials from the October 2010 CalEERAM revision.

Riverside's target is below average for the 12 utilities in the detailed study. Riverside's residential market savings potential is close to average, and its nonresidential savings potential is below average.

**Figure 100: Riverside's 10-Year Cumulative Targets, Compared With 12 of the Largest POUs**



Source: Data obtained from California Municipal Utilities Association, *Energy Efficiency in California's Public Power Sector. A Status Report*, March 2010, combined with California Energy Efficiency Resource Assessment Models (October 2010).

### *Summary of Target Adequacy*

In this section KEMA examines adopted targets across all four AB 2021 target assessment criteria. **Table 24** summarizes the findings. Riverside's targets meet both cost-effectiveness and feasibility criteria. Riverside does not, however, have a demonstrated track record of meeting its energy efficiency targets. This may prove easier to do in the future with its lower revised targets. Riverside's revised targets do not meet AB 2021's energy use reduction goal.

**Table 24: Target Assessment—Riverside**

Target Criterion	Criteria Description	How Well Does It Meet This Criterion?
Cost-Effectiveness	TRC ratio $\geq 1$	TRC ratio = 2.46
Feasibility	<ul style="list-style-type: none"> <li>Revised targets are reasonably related to reported savings (2006-2009)?</li> <li>Revised targets are reasonably related to market savings potential?</li> <li>Annual ramp-up rate in future years is reasonable?</li> <li>Budget and staffing is likely to be in place to achieve targets?</li> </ul>	<p>Targets are slightly below 2009 reported savings.</p> <p>Targets are in line with estimated market savings potential.</p> <p>Ramp-up 2012-2016 is moderately aggressive but achievable with appropriate budget and staffing.</p> <p>Additional budget and staffing will probably be required to meet targets. Riverside may add one additional staff member.</p>
Reliability	<ul style="list-style-type: none"> <li>Successfully achieved 2007 targets in most years?</li> <li>Utility performs regular EM&amp;V?</li> </ul>	<p>Riverside did not meet its savings targets in 2007, 2008, or 2009.</p> <p>Riverside is in the process of performing EM&amp;V on its programs.</p>
Energy Use Reduction	<ul style="list-style-type: none"> <li>Meets 10% reduction over 10 years?</li> </ul>	Current targets reach 6.9% of 2020 forecasted energy use over 10 years

### Options for Increasing Efficiency

KEMA altered the inputs to Riverside's model to see what changes would be required for the market savings potential to meet AB 2021's energy use reduction requirement. KEMA increased Riverside's incentive levels incrementally until market savings potential achieved 10 percent over 10 years. Setting incentives at 65 percent of incremental measure cost produced a 10 percent cumulative savings over 10 years, with an overall TRC ratio of 2.45 and a 2011 cost of 38 cents per first-year kWh (increasing to 63 cents per kWh by 2020). By comparison, Riverside's existing program has an overall TRC ratio of 4.2 and cost of about 26 cents per kWh in fiscal year 2008/2009.<sup>45</sup>

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<sup>45</sup> Calculated from program data in CMUA (2010), Table 7.

## Roseville

### Summary of Revised Targets

Efficiency savings for Roseville Electric (Roseville) in fiscal year 2008/2009 represented 1.3 percent of all POU (including SMUD and LADWP) energy efficiency savings (CMUA 2010). Roseville's 2007 targets represented a significant increase over its 2006 program savings. Although its savings fell short of its target in 2007, by 2008 and 2009 Roseville met the targets set in 2007. Roseville's new targets for 2011 through 2015 are close to its old targets and increase only slightly over that period. The targets increase sharply in 2016 and 2017, then decline through 2020. The targets are lower than the estimated market savings potential from 2012 to 2016 but, from 2017 to 2020, the targets are actually higher than the estimated potential. The cumulative total of the program savings targets from 2011 to 2020 are equivalent to 5.6 percent of forecasted electricity use for 2020.

### Key Analytical Differences From Other Utilities

Roseville's efficiency model contained a number of key differences from most of the other utilities studied. This helps explain differences in Roseville's technical, economic, and market savings potential estimates.

- Roseville explicitly excluded a number of measures from the analysis even though they passed the TRC test. It also explicitly included one measure despite the fact that it failed the TRC test. **Table 25** shows these excluded and included measures.

**Table 25: Measures Explicitly Excluded or Included in Analysis—Roseville**

	Residential	Commercial	Industrial
Exclusions	CFLs LED holiday lights LED exit signs (multifamily) Photocells Occupancy sensors Hot water heating tank wraps	Hardwired CFL fixtures Hardwired fluorescent fixture Metal halide fixture Time clocks High-efficiency electric resistance water heater Chillers Refrigerant charge Vending machine controllers for uncooled machines Griddles Steamers Hot food holding cabinets	Heating
Inclusions		Package System A/C ( $\geq 63.3$ tons, 10.2 EER) (passes for some building types but not all)	

Source: Data obtained from California Energy Efficiency Resource Assessment Model (October 2010).

- The default measure list adopted by most of the utilities included 16 SEER (13 EER) split-system air conditioners for single-family residential, which failed the TRC test in all but the hottest climate zones. Roseville replaced the 16 SEER measure with a 15 SEER (12.72 EER) split-system air conditioner, which passed the TRC test in Roseville’s climate zone. Roseville was one of only two utilities studied with a passing AC measure (the 16 SEER unit passed for Imperial Irrigation District).
- In estimating market savings potential, Roseville was one of only 3 of the 12 utilities that deviated from 50 percent incentives for the scenario analyzed for the residential sector, and the only utility to use incentives different than 50 percent for the commercial sector. **Table 26** shows the incentive levels used for the scenario, expressed as a percentage of incremental cost. The incentive for commercial lighting, at 75 percent, is higher than the 50 percent assumed by the other utilities, but all other end uses had lower incentive levels.

**Table 26: Scenario Incentives, Percentage of Incremental Cost—Roseville**

	Residential	Commercial
Lighting	0.0%	75.0%
Water Heating	0.0%	0.5%
Appliances	15.0%	25.0%
HVAC/Shell	10.0%	10.0%

Source: Analysis based on California Energy Efficiency Resource Assessment Models (October 2010).

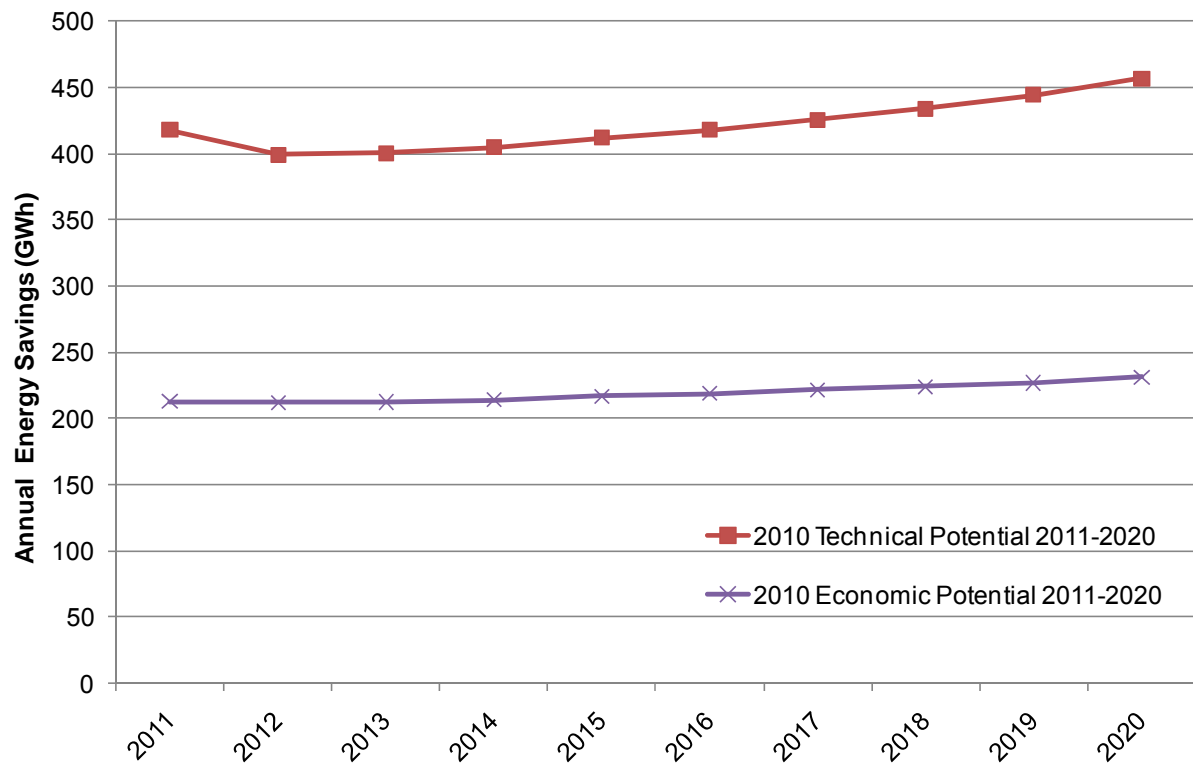
To assess this different assumption, KEMA reran the model using 50 percent incentives for all end uses. The result was a 26 percent decrease in savings and a 50 percent reduction in the overall 2011 budget. In other words, under Roseville’s incentives the increased savings from more commercial lighting incentives more than offset the reduced savings for all other end uses.

## Technical and Economic Savings Potential

**Figure 101** (energy) and **Figure 102** (demand) show Roseville’s technical and economic savings potential, as developed in its revised CalEERAM model from October 2010. Saving dip in 2012 due to federal lighting standard that will improve the efficacy of baseline lighting and reduce the savings potential for CFLs. Savings then begin climbing through the end of the forecast, averaging 1.7 percent growth per year.

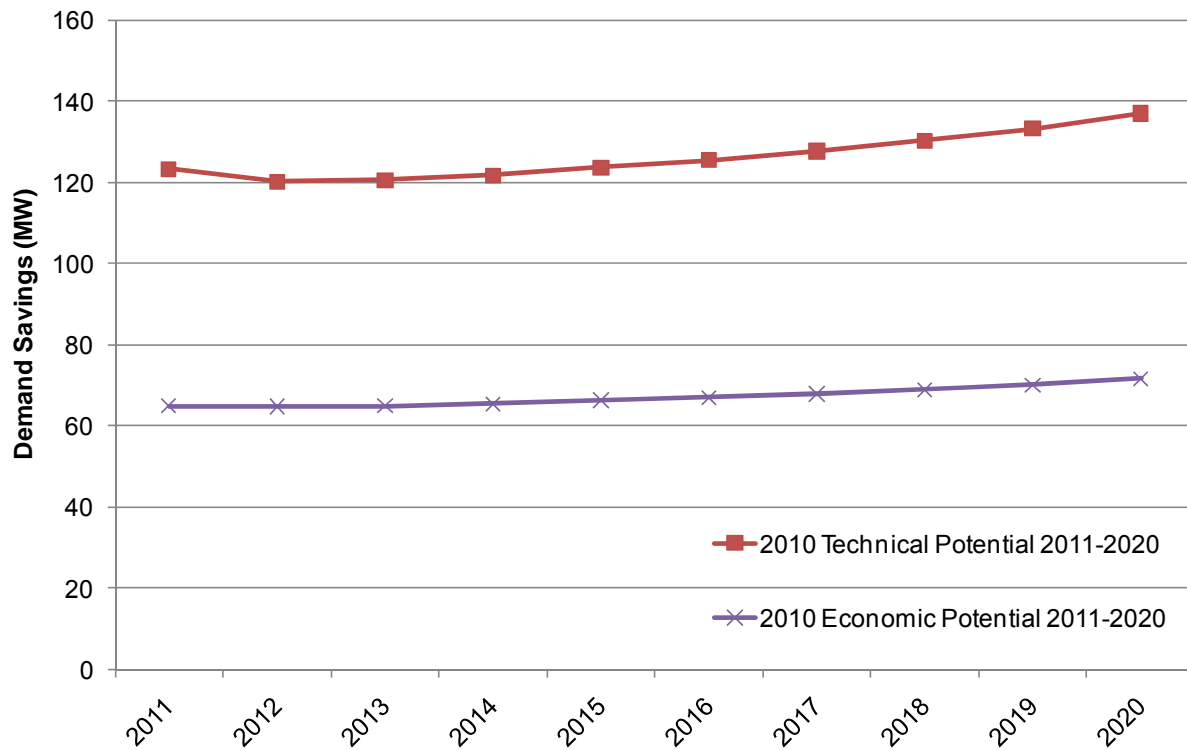
Roseville has the largest gap between technical and economic savings potential of the 12 utilities. The authors attribute this to Roseville’s excluded measures. (See **Table 25**.) Because these measures are included in technical but excluded from economic savings potential, this measure exclusion appears as a large fall-off from technical savings potential to economic savings potential.

**Figure 101: Technical and Economical Energy Savings Potential (MWh)—Roseville**



Source: Data obtained from California Energy Efficiency Resource Assessment Model (October 2010).

**Figure 102: Technical and Economic Demand Savings Potential (MW)—Roseville**

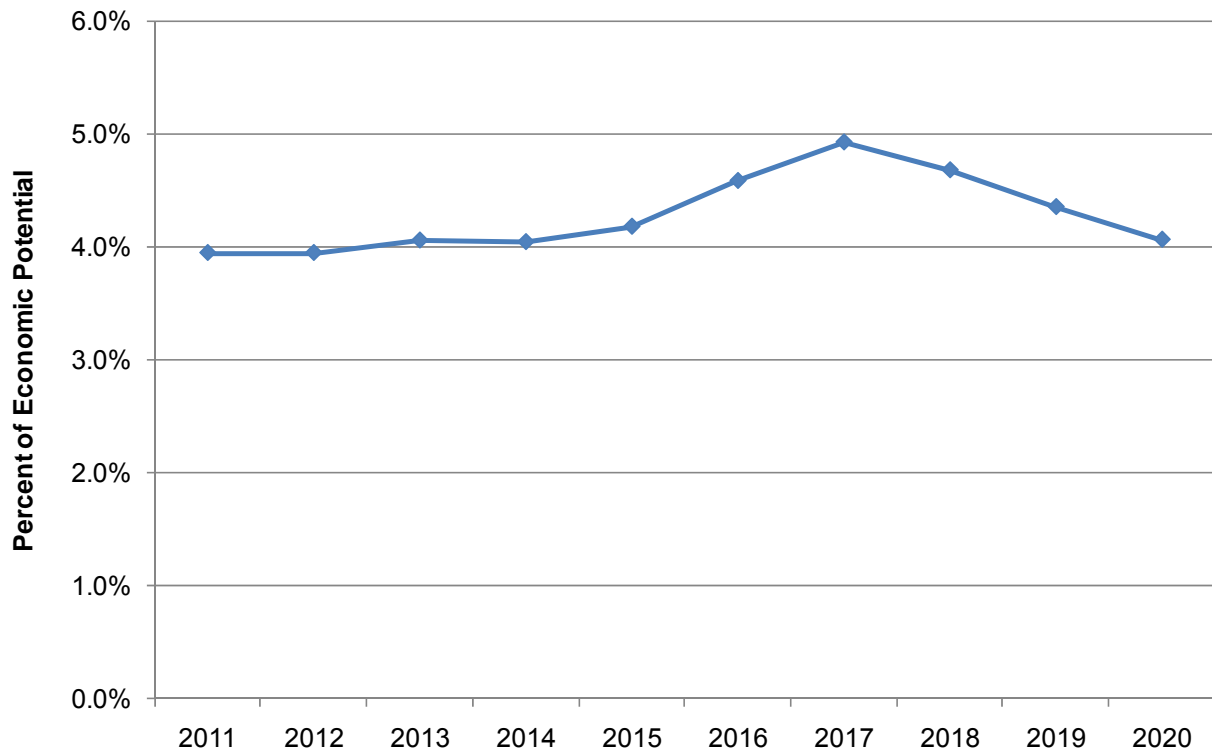


Source: Data obtained from California Energy Efficiency Resource Assessment Model (October 2010).

### Market Savings Potential and Utility Targets

**Figure 103** shows Roseville's energy savings targets as a percentage of economic savings potential.

**Figure 103: Target Energy Savings as a Percentage of Economic Savings Potential—Roseville**

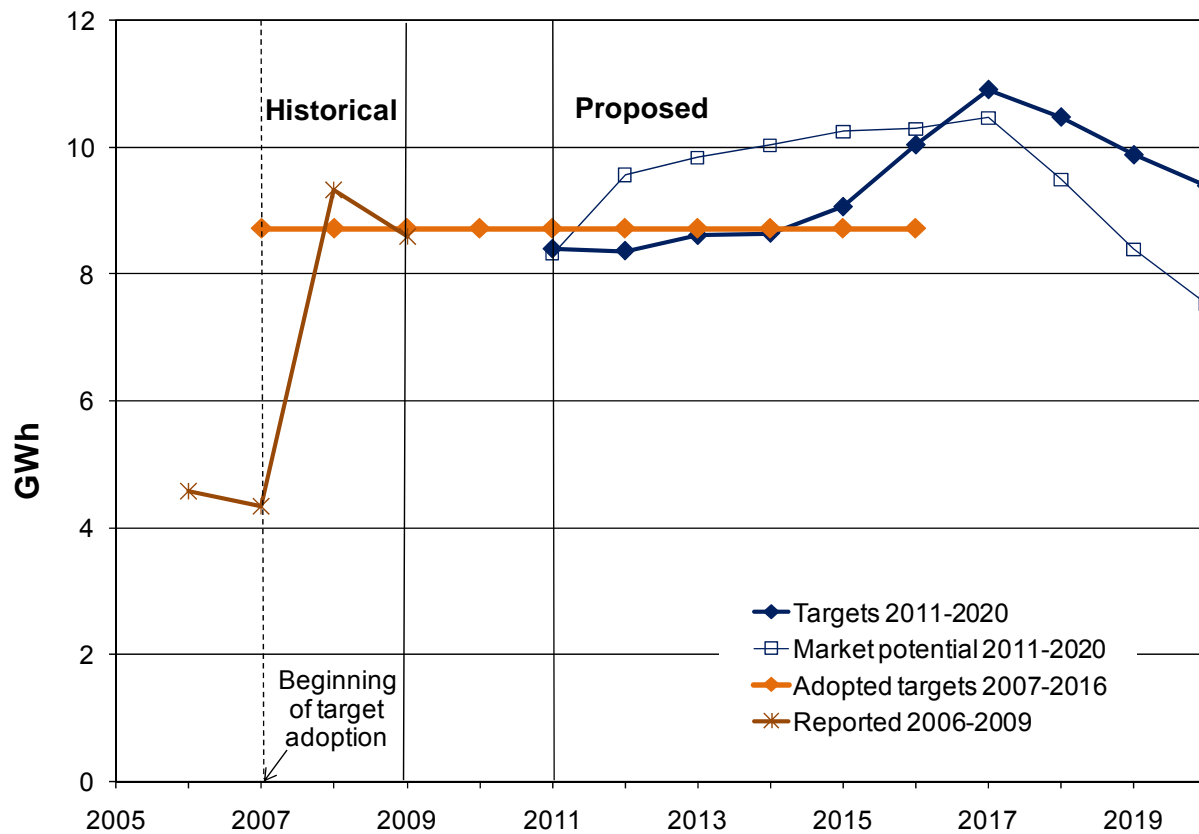


Source: Data obtained from California Municipal Utilities Association, *Energy Efficiency in California's Public Power Sector. A Status Report*, March 2010, combined with California Energy Efficiency Resource Assessment Models (October 2010).

**Figure 104** shows Roseville's new targets for 2011 to 2020 as compared with previous targets, past program savings, and recent estimates of market savings potential. Roseville's new targets for 2011 through 2015 are comparable to its older targets. In 2016 and 2017, however, the targets rise, then decline through 2020, although they remain higher than the old targets.

The ramp-up rate is quite modest compared to the other utilities, with an annualized increase of 5.5 percent per year between 2012 and 2017. (See **Figure 25** and its accompanying discussion.) The average ramp-up between 2012 (the lowest year for most of the utilities) and the highest level is 31 percent. Most of the utilities begin ramping up in 2013 and peak in 2015 or 2016; Roseville's targets are relatively flat until 2016.

**Figure 104: Roseville's Historical Annual Energy Efficiency Program Savings and Targets**



Source: Data for 2011-2020 targets obtained from California Municipal Utilities Association, *Energy Efficiency in California's Public Power Sector. A Status Report*, March 2010. Data for 2011-2020 market potential obtained from California Energy Efficiency Resource Assessment Models (October 2010). Data for 2009 reported savings obtained from California Municipal Utilities Association, *Energy Efficiency in California's Public Power Sector. A Status Report*, March 2009. Data for 2007-2016 targets obtained from California Municipal Utilities Association, *Establishing Energy Efficiency Targets: A Public Power Response to AB2021. Final Update*, October 2007.

Through 2016, the targets are lower than market savings potential. From 2017 onward, however, the targets exceed the market savings potential. (The targets were set before the model revisions.) The revised market savings potential suggests that targets may not be aggressive enough in the early part of the forecast period and too aggressive in later years.

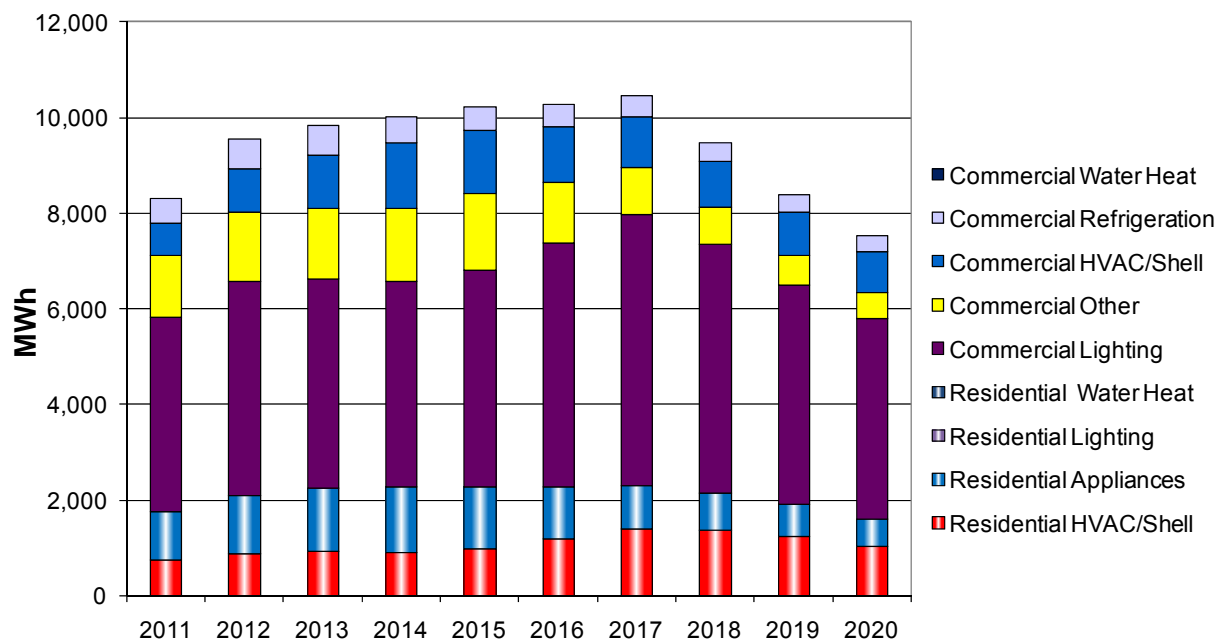
Developments in commercial lighting, especially high-bay T5 lighting in retail and miscellaneous buildings, drive the decline in market savings potential after 2017. Awareness for this measure reaches 100 percent in 2017; without increasing awareness, the decline in potential participants drives the savings. (The more customers convert to T5s, the smaller the pool of potential participants.)

Roseville met or almost met its target in 2008 and 2009 (after falling short in 2007). This success indicates that Roseville can probably meet its targets with its current programs.

## Market Savings Potential by End Use

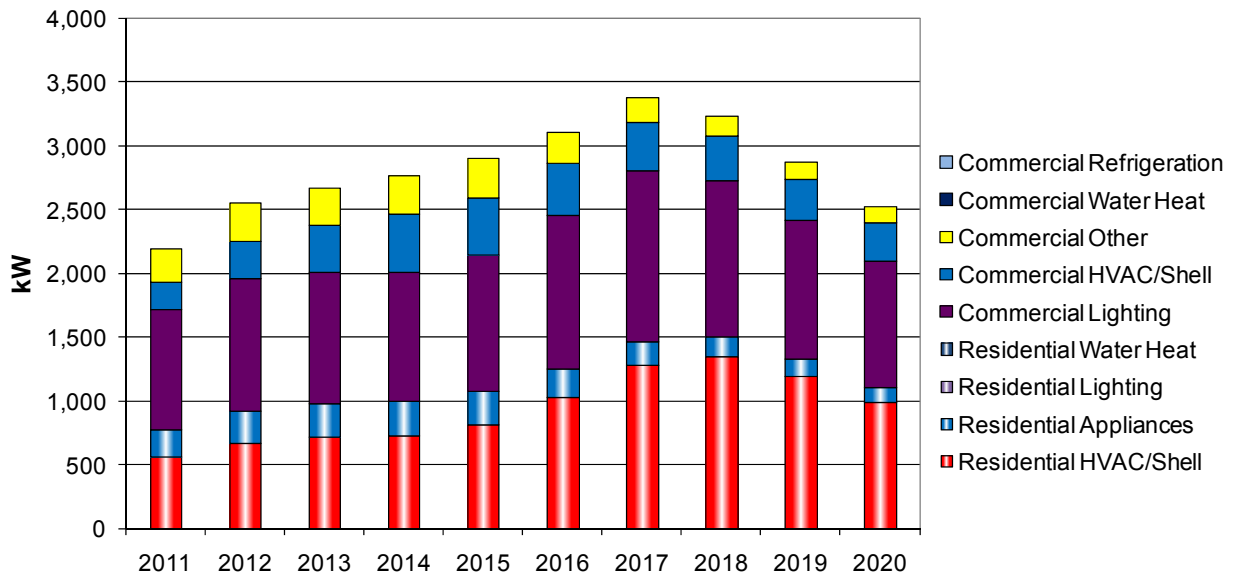
KEMA used revised 2010 CalEERAM data to break out market savings potential to show opportunities for specific programs by both customer sector and end-use category. **Figure 105** and **Figure 106** show market energy and peak demand savings potential, respectively, by sector and end use. Commercial lighting is the largest contributor to market energy savings potential. Residential appliances, residential HVAC, commercial HVAC/shell, and commercial “other” also contribute significantly to energy savings. Their relative importance varies over the forecast period. Residential HVAC and commercial lighting are the most significant contributors to market peak demand savings potential.

**Figure 105: Roseville’s Market Savings Potential (MWh) by End Use**



Source: Data obtained from California Energy Efficiency Resource Assessment Model (October 2010).

**Figure 106: Roseville's Market Savings Potential (kW) by End Use**



Source: Data obtained from California Energy Efficiency Resource Assessment Model (October 2010).

### Program Factors Affecting Target Feasibility and Reliability

Roseville can meet its targets only with a realistic vision and a credible implementation plan.

Roseville uses a 10-year horizon for efficiency planning. Within the 10-year horizon, several shorter planning tracks allow Roseville to respond to budgetary, market, and technology changes and trends. These tracks are 3 years, 1 year, and 1 – 12 months. The Roseville City Council approves budgets annually by based on fiscal year starting July 1. Future funding projections are part of the city council's resource planning. Roseville describes these as highly uncertain given recent economic downturn.

Roseville has found that, since 2005, as much as 25 percent of its planning has required modification within the fiscal year. Roseville has found that measures that are successful elsewhere do not necessarily work within the 31-square-mile, unique demographics of its service territory.

Roseville usually makes program changes between November and January. These changes are typically due to:

- Recent rapid and erratic changes in customer use patterns and utility revenues.
- A change in focus on kWh goals (if a program is not performing, Roseville will change or cancel it within the fiscal year and replace it).
- Technology changes.
- New third-party or grant opportunities.

Roseville reports that this flexibility has produced significant results. Before 2006, the utility often left programs in place far too long, resulting in poor performance.

Roseville identifies staffing issues, market saturation, standards, uncertainty about new technologies, and the economy as potential barriers to meeting its targets. Market saturation and standards will reduce or eliminate the savings potential for the “old standbys” of Roseville’s past programs. Roseville is not confident that customers will accept new technologies as quickly as they have in the past.

Roseville anticipates very little staff growth in the next five years. Staffing is affected by revenue and reductions in energy use that have occurred as a result of the slow economy. Roseville is already experiencing the effect of inadequate staffing and has turned to third-party contractors to extend its programs.

Roseville expects to offer more bundled or multimeasure customer rebates in the future. This means that it will take longer to educate customers, which in turn will slow down customer acceptance. This will increase energy efficiency costs.

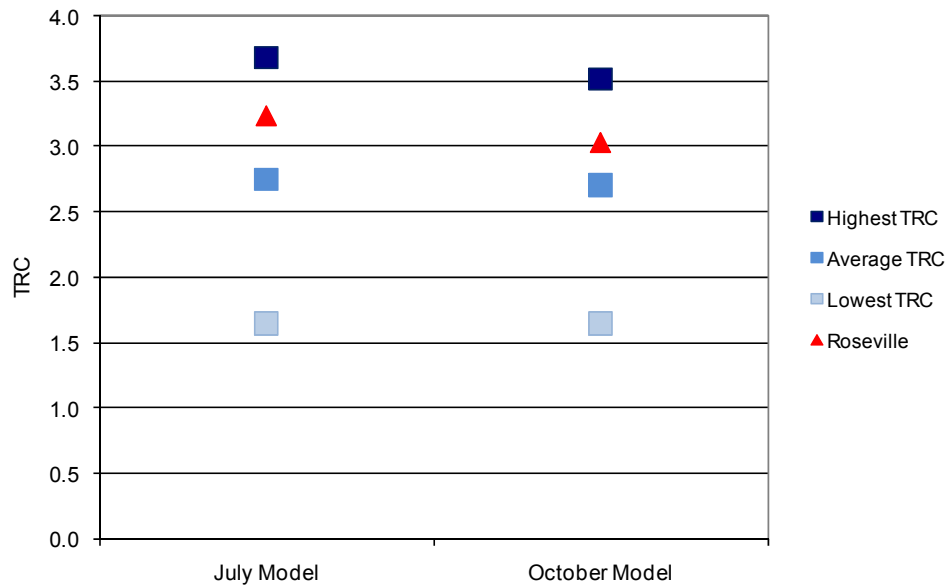
Roseville also expects to focus on load-shifting technologies as a regular part of its portfolio.

### Program Cost-Effectiveness

Roseville’s fiscal year 2008/2009 programs had a TRC ratio of 3.89 (CMUA 2010, Table 7). The CalEERAM model used to set the targets shows a TRC ratio of 3.23. The error in the version of the model used to create this value increases the uncertainty in the TRC ratio estimate, so reviewers also looked at the revised CalEERAM’s market savings potential, which is 3.02. **Figure 107** shows the two TRC ratios for Roseville, compared with the other utilities. Roseville’s TRC ratio is higher than average, reflecting a program design that focuses on highly cost-effective commercial lighting measures (while offering few or no incentives for other end uses).

The cost per kWh savings from Roseville’s model was 21 cents for residential and 32 cents for nonresidential in 2015, compared with an average of 58 cents for residential and 36 cents for nonresidential across all the POU models studied. Roseville’s residential cost is the lowest among the utilities, while its nonresidential cost was lower than average.

**Figure 107: Roseville's TRC Ratios From the Two CalEERAM Versions, Compared to Other POUs**



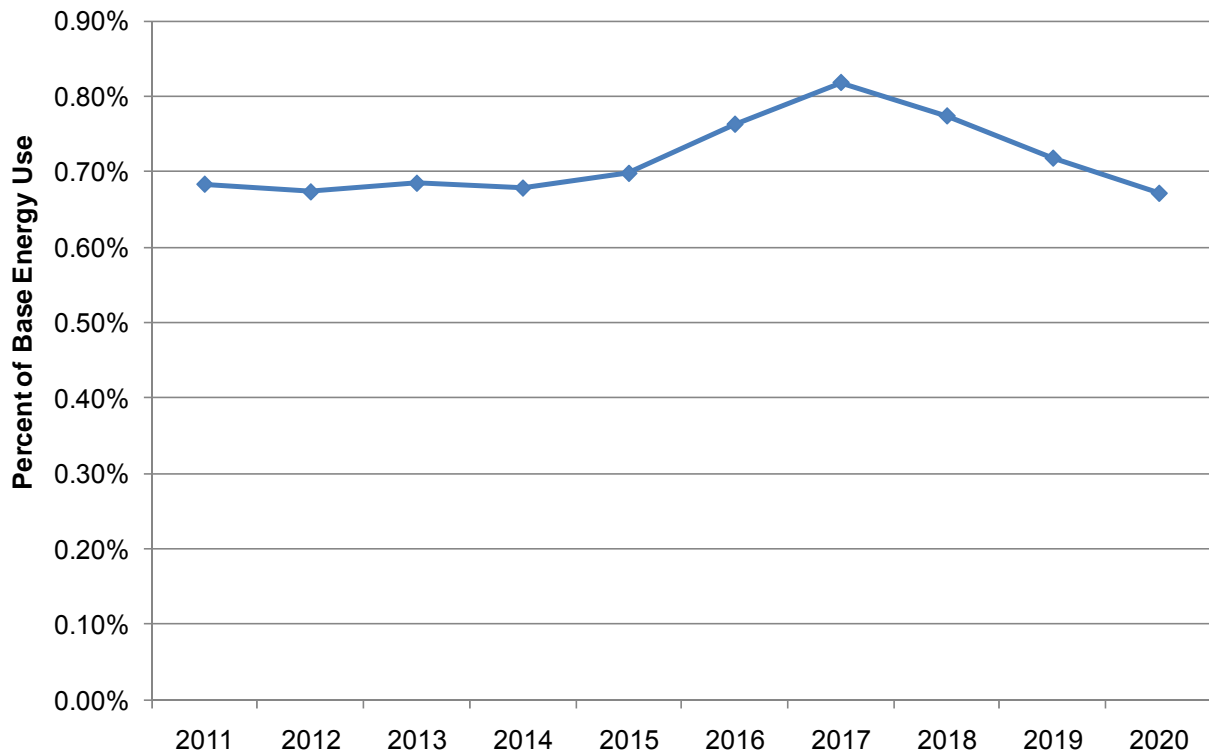
Source: Data obtained from California Energy Efficiency Resource Assessment Model (October 2010) and (July 2010) versions.

The CalEERAM model suggests an overall market savings potential cost of between 26 cents and 45 cents over the forecast period. The targets are different from the market savings potential, so this may not accurately represent the actual cost of meeting the target.

### Targets' Contribution to Energy Use Reduction

**Figure 108** shows target energy savings as a percentage of total load. Cumulatively, the targets add up to 5.6 percent of one year of energy use for 2020 (based on the energy use forecast in the CalEERAM model, taken from the 2009 IEPR), which does not meet the 10 percent energy use reduction required by AB 2021.

**Figure 108: Target Energy Savings as a Percentage of Base Energy Use—Roseville**



Source: Data obtained from California Municipal Utilities Association, *Energy Efficiency in California's Public Power Sector. A Status Report*, March 2010.

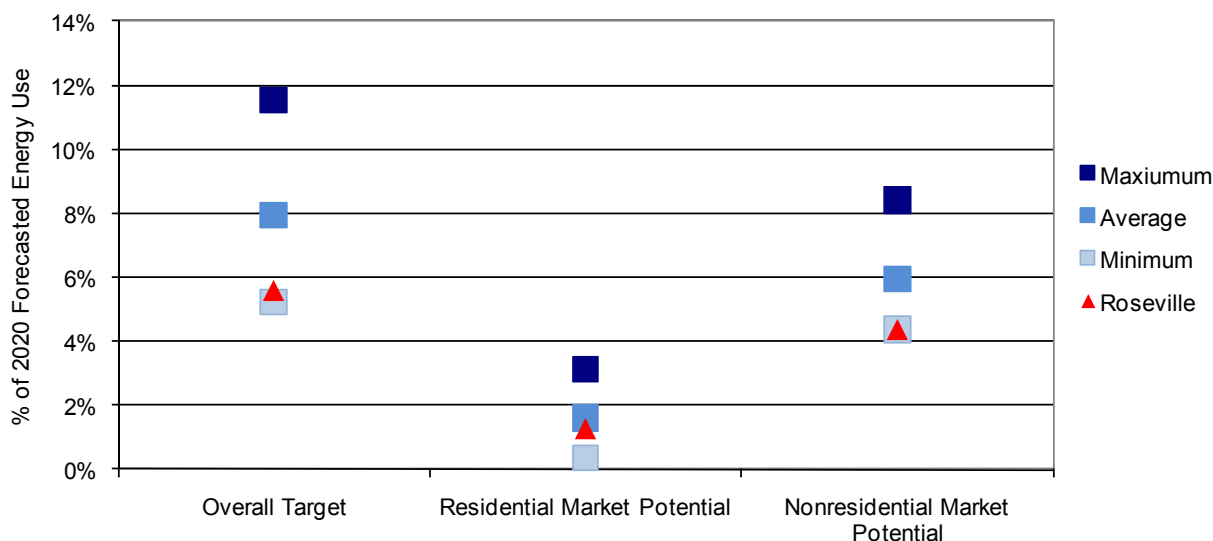
## Assessment of Targets

In this section, KEMA evaluates Roseville's targets by first comparing them with those of the other POUs, and then evaluating whether they adequately meet AB 2021 criteria (cost-effectiveness, feasibility, reliability, and energy use reduction).

**Figure 109** shows the sum of Roseville's 2011-2020 targets as a percentage of energy use, relative to those of other POUs. The overall target is from the March 2010 CMUA report and represents Roseville's current commitments. Because the CMUA report did not break out targets by sector, **Figure 109** shows the sector breakdowns of market savings potentials from the October 2010 CalEERAM revision. However, because of the calibration process, reviewers believe this is a fair representation of Roseville's targets, broken out by sector.

Roseville's overall target is equal to the median of the other POUs but lower than the average. Looking at the market savings potentials by sector, Roseville is below average for both residential and nonresidential.

**Figure 109: Roseville's Targets Compared With All POUs**



Source: Data obtained from California Municipal Utilities Association, *Energy Efficiency in California's Public Power Sector. A Status Report*, March 2010, combined with California Energy Efficiency Resource Assessment Models (October 2010).

### Summary of Target Adequacy

In this section KEMA examines adopted targets across all four AB 2021 target assessment criteria. **Table 27** summarizes the findings. Roseville's targets meet all of the criteria except one: the 10-percent energy use reduction goal.

**Table 27: Target Assessment—Roseville**

<b>Target Criterion</b>	<b>Criteria Description</b>	<b>How Well Does It Meet This Criterion?</b>
Cost-Effectiveness	TRC ratio $\geq 1$	TRC ratio = 3.23
Feasibility	<ul style="list-style-type: none"> <li>Revised targets are reasonably related to reported savings (2006-2009)?</li> <li>Revised targets are reasonably related to market savings potential?</li> <li>Annual ramp-up rate in future years is reasonable?</li> <li>Budget and staffing is likely to be in place to achieve targets?</li> </ul>	<p>Targets are in line with 2008-2009 reported savings.</p> <p>Cumulative targets are very close to cumulative market savings potentials. Although the shape of the curve is different, the degree of shifting is probably feasible.</p> <p>Slight ramp-up in 2016-17 is achievable.</p> <p>Current budget and staffing are probably adequate to meet targets.</p>
Reliability	<ul style="list-style-type: none"> <li>Successfully achieved 2007 targets in most years?</li> <li>Utility performs regular EM&amp;V?</li> </ul>	<p>Roseville increased its efficiency savings by 88% from 2006-2009, met its 2008 targets and fell only 1.5% short of its 2009 targets.</p> <p>Roseville completed third party EM&amp;V impact studies of its 2008 and 2009 programs.</p>
Energy Use Reduction	<ul style="list-style-type: none"> <li>Meets 10% reduction over 10 years?</li> </ul>	Current targets reach 5.6% of base use over 10 years

Roseville's cost per kWh saved is lower than other POU's, but its TRC ratio is higher, indicating that the utility could possibly expand its programs while maintaining its program cost-effectiveness.

### Options for Increasing Efficiency

KEMA altered the inputs to Roseville's model to see what changes would be required to meet the AB 2021 requirement to reduce energy use. KEMA applied the cost-effectiveness rule (TRC ratio  $\geq 1$ ) to all measures to determine whether to include them in the analysis. KEMA then replaced Roseville's incentive levels with progressively higher incentives until savings met the 10 percent goal. Setting incentives at 80 percent of incremental measure cost produced a 10

percent cumulative savings over 10 years with an overall TRC ratio of 2.85 and a first-year cost of 35 cents per kWh (increasing to 56 cents per kWh by 2020). By comparison, Roseville's existing program has an overall TRC ratio of 3.89 and cost 33 cents per kWh in fiscal year 2008/2009.<sup>46</sup>

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<sup>46</sup> Calculated from program data in CMUA (2010), Table 7.

## Silicon Valley Power

### Summary of Revised Targets

Efficiency savings for Silicon Valley Power (Silicon Valley) in fiscal year 2008/2009 represented 6.2 percent of all POU (including SMUD and LADWP) energy efficiency savings (*CMUA 2010*). Silicon Valley's 2007 targets represented a significant increase over its 2006 program savings. Although its savings fell short of targets in 2007, Silicon Valley came close to meeting its 2008 targets and exceeded 2009 targets. Silicon Valley's new targets for 2011 and 2012 are slightly lower than the targets set in 2007. The new targets are higher from 2013 to 2016 but drop to lower levels through the end of the forecast period. The revised targets are lower than 2009 reported savings for the entire forecast period. The cumulative total of the program savings targets from 2011 to 2020 represent 7.3 percent of forecasted electricity use for 2020.

### Key Analytical Differences From Other Utilities

Silicon Valley's CalEERAM model did not have any major differences from most of the other POUs.

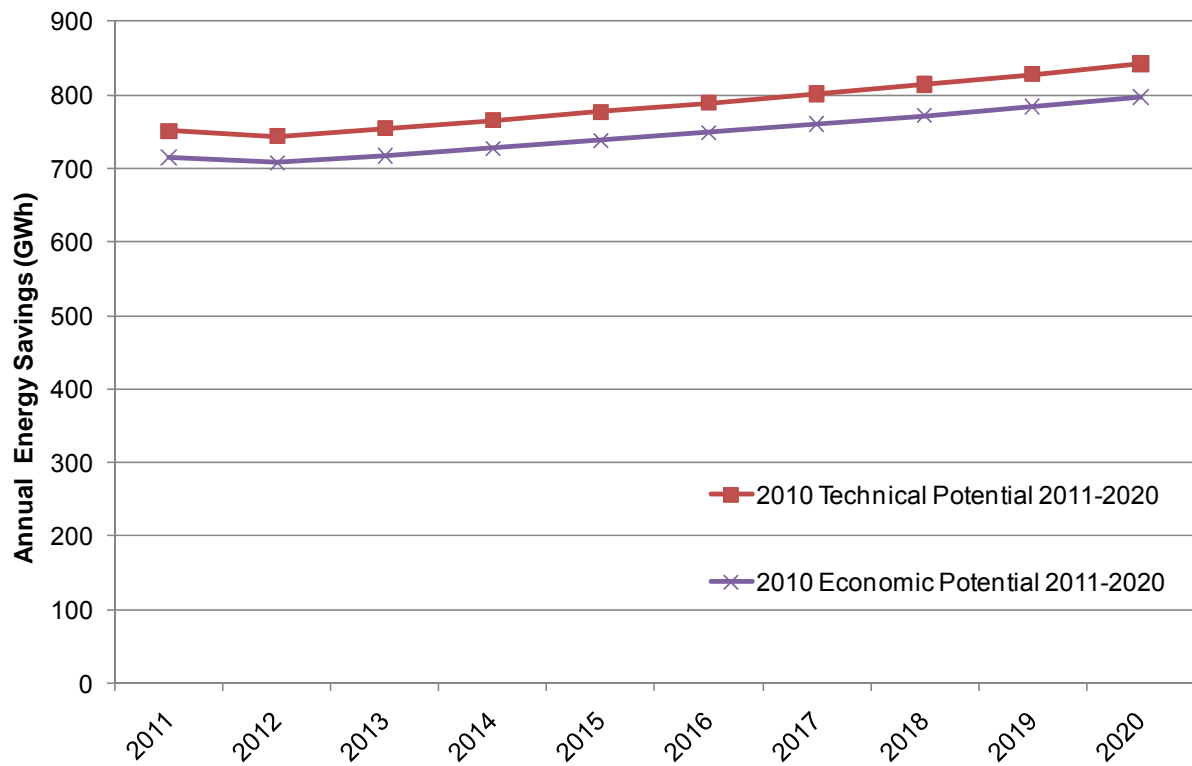
Silicon Valley is unusual in that, at 9 percent, it had the lowest share of residential energy use.

### Technical and Economic Savings Potential

**Figure 110** (energy) and **Figure 111** (demand) show Silicon Valley's technical and economic savings potential, as developed in its revised October 2010 CalEERAM model. Savings dip slightly in 2012 due to new federal lighting standards that will improve the efficiency of baseline lighting and reduce savings potential for CFLs. Savings then climb through the end of the forecast, averaging 1.6 percent growth per year.

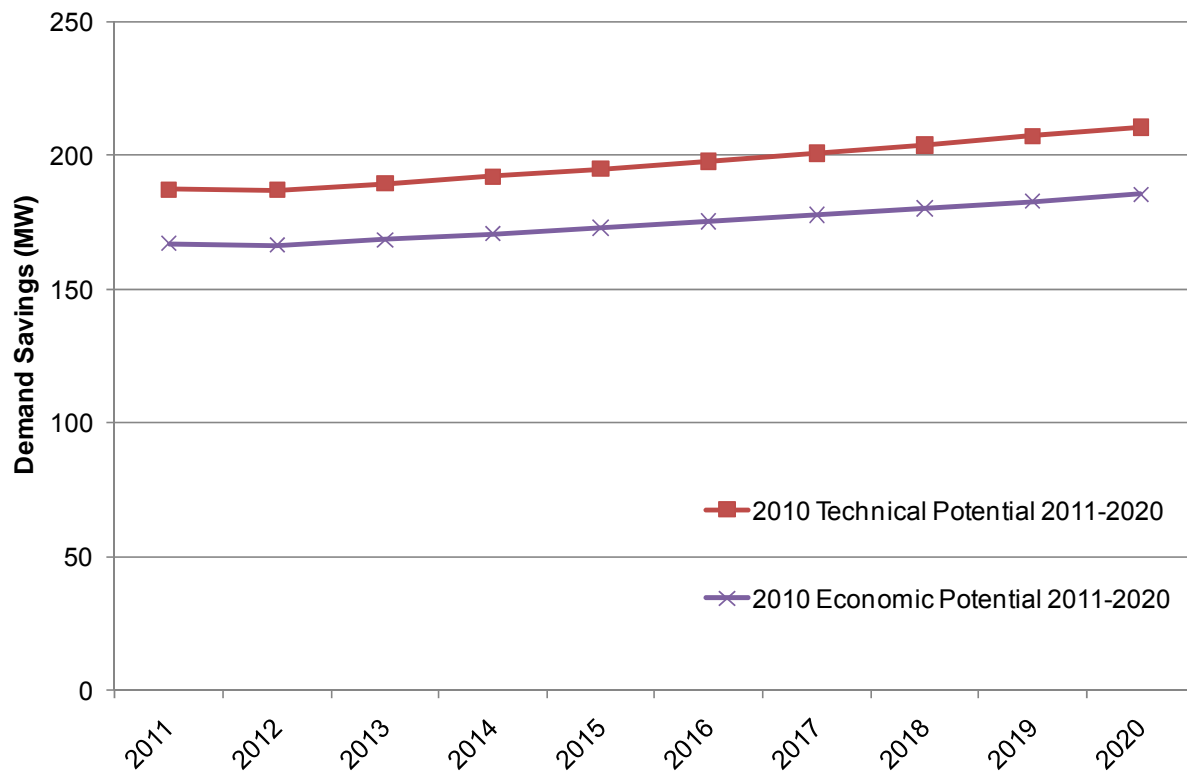
Of the 12 POUs studied, Silicon Valley had the lowest technical savings potential as a percentage of energy use. Forty-six percent of Silicon Valley's nonresidential energy use (42 percent of its total energy use) is in the electronics industry, which had technical savings potential of only 12 percent. This pushed down Silicon Valley's overall potential.

**Figure 110: Technical and Economical Energy Savings Potential (MWh)—Silicon Valley**



Source: Data obtained from California Energy Efficiency Resource Assessment Model (October 2010).

**Figure 111: Technical and Economic Demand Savings Potential (MW)—Silicon Valley**

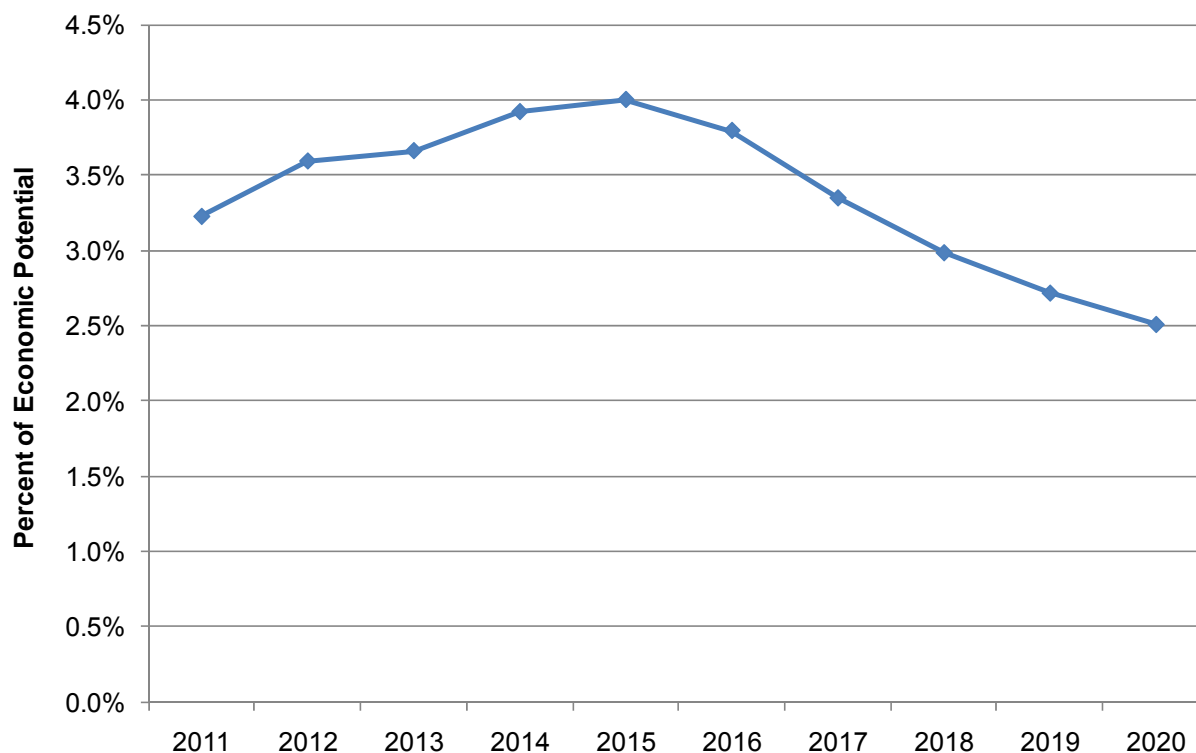


Source: Data obtained from California Energy Efficiency Resource Assessment Model (October 2010).

### Market Savings Potential and Targets

**Figure 112** shows Silicon Valley's energy savings targets as a percentage of economic savings potential. Silicon Valley was the only POU of the 12 with targets lower in 2020 than in 2011 (in absolute terms, not just as a percentage of economic savings potential).

**Figure 112: Target Energy Savings as a Percentage of Economic Savings Potential—Silicon Valley**

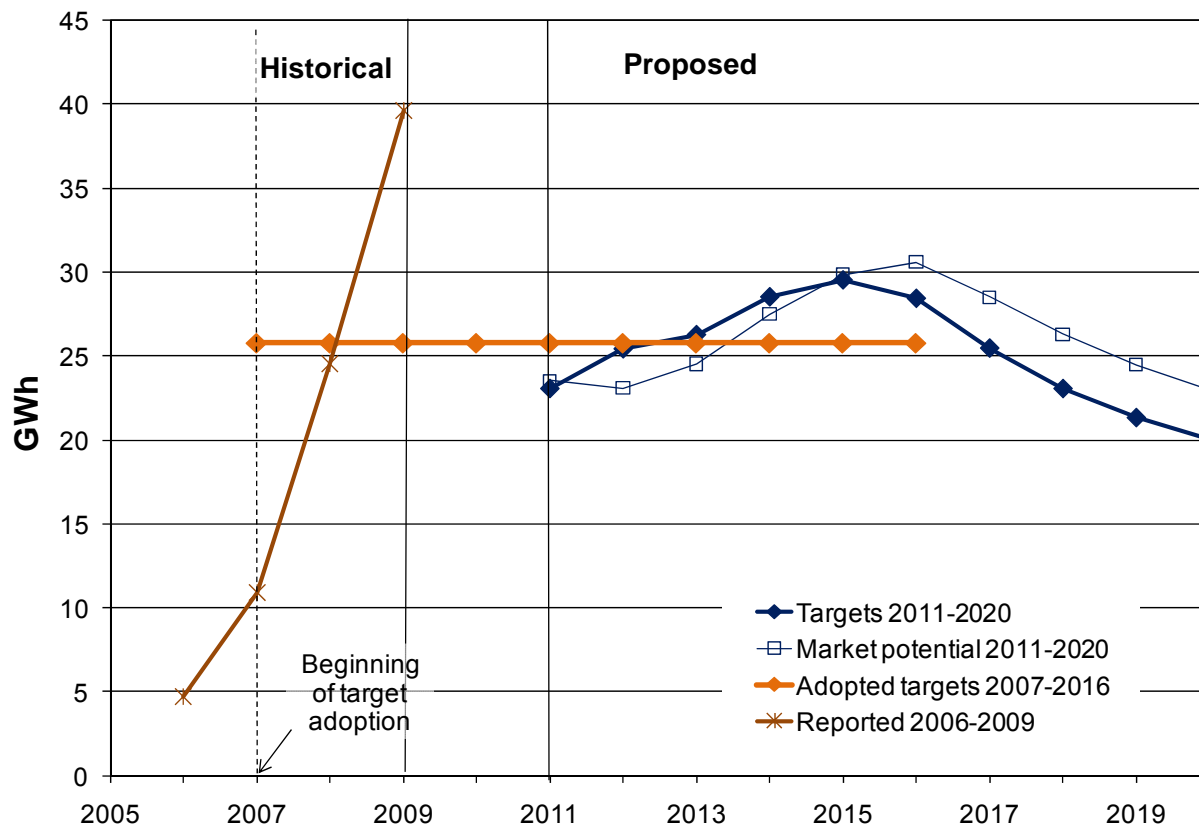


Source: Data obtained from California Municipal Utilities Association, *Energy Efficiency in California's Public Power Sector. A Status Report*, March 2010, combined with California Energy Efficiency Resource Assessment Models (October 2010).

**Figure 113** shows Silicon Valley's new targets for 2011 to 2020 compared with its previous targets, past program savings, and most recent market savings potential estimates. Silicon Valley's 2007 targets were flat. The revised targets were based on the market savings potentials from the CMUA March 2010 report; they increase, then decrease over the period. On average, however, they are similar to older targets. The revised 2011 target is close to Silicon Valley's 2008 reported savings but lower than the utility's 2009 reported savings.

The ramp-up rate in Silicon Valley's targets is moderate compared with other utilities, with an annualized growth rate of about 6 percent per year between 2011 and 2015.

**Figure 113: Silicon Valley's Historical Annual Energy Efficiency Program Savings and Targets**



Source: Data for 2011-2020 targets obtained from California Municipal Utilities Association, *Energy Efficiency in California's Public Power Sector. A Status Report*, March 2010. Data for 2011-2020 market potential obtained from California Energy Efficiency Resource Assessment Models (October 2010). Data for 2009 reported savings obtained from California Municipal Utilities Association, *Energy Efficiency in California's Public Power Sector. A Status Report*, March 2009. Data for 2007-2016 targets obtained from California Municipal Utilities Association, *Establishing Energy Efficiency Targets: A Public Power Response to AB2021. Final Update*, October 2007.

Silicon Valley's 2011-2020 targets are higher than its market savings potential in the early years of the forecast and lower in later years.<sup>47</sup> Cumulative targets are slightly lower than cumulative market savings potential, indicating that the targets should be achievable overall.

What is happening in the nonresidential sector drives the decline in market savings potential after 2015. Awareness for most commercial measures reaches 100 percent by 2015 and most industrial measures by 2017; without increasing awareness, the decline in potential participants

<sup>47</sup> For the March 2010 CMUA report, Silicon Valley's targets were set the same as its market savings potential. The October model revision produced market savings potentials that were different from the March report. (See Figure 4 and its accompanying discussion.)

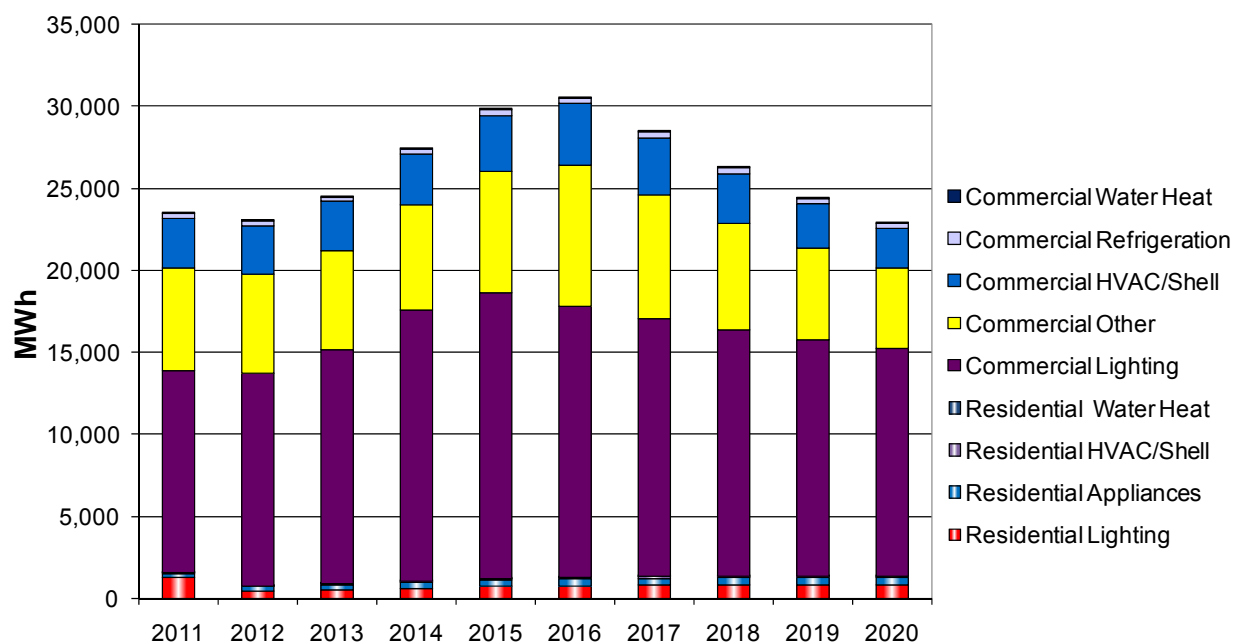
drives savings. (The more customers adopt high-efficiency measures, the smaller the pool of potential participants.)

Looking at Silicon Valley's historical savings, Silicon Valley met or almost met its target in 2008 and 2009 (after falling short in 2007). This success indicates that Silicon Valley can probably meet its targets with its current programs.

### Market Savings Potential by End Use

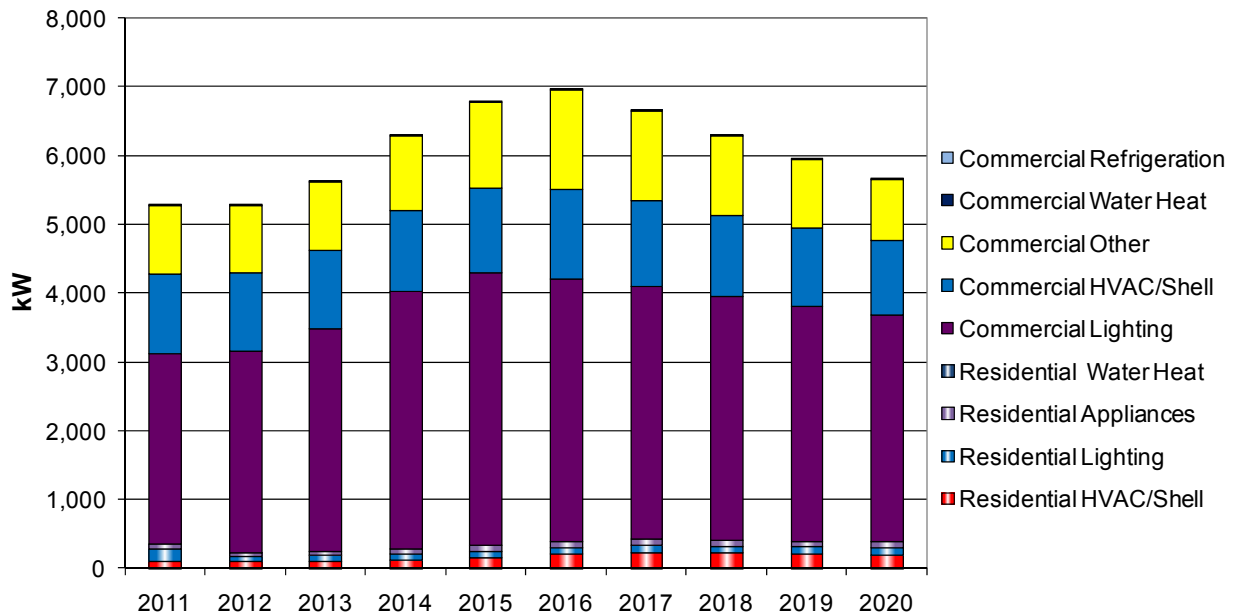
KEMA used revised 2010 CalEERAM data to break out market savings potential to show opportunities for specific programs by both customer sector and end-use category. **Figure 114** and **Figure 115** show market energy and peak demand savings potential, respectively, by sector and end use. Commercial lighting is the largest contributor to market energy savings potential, followed by commercial "other," which includes some industrial end uses. Commercial lighting dominates market peak demand savings potential, followed by commercial HVAC and commercial "other."

**Figure 114: Silicon Valley's Market Savings Potential (MWh) by End Use**



Source: Data obtained from California Energy Efficiency Resource Assessment Model (October 2010).

**Figure 115: Silicon Valley's Market Savings Potential (kW) by End Use**



Source: Data obtained from California Energy Efficiency Resource Assessment Model (October 2010).

### Program Factors Affecting Target Feasibility and Reliability

Silicon Valley proposes a five-year plan for energy efficiency programs to the Santa Clara city council for approval. The utility often updates this annually to adjust for market changes, including customer behavior and market acceptance of emerging technologies. As part of this plan, Silicon Valley periodically issues requests for proposals for third-party energy efficiency programs to supplement its standard programs. These programs often target hard-to-reach or specialized areas such as compressed air or refrigeration measures. Budgets are set annually. The city council develops the annual budget between January and March and approves it in June. Budgets match the public benefit charge dollars, collected annually. Additional funding requires city council approval.

Silicon Valley currently has one full-time program manager, who has responsibility for all public benefit programs in addition to his/her other duties. One energy conservation specialist is responsible for both residential energy efficiency program implementation and the low-income rate assistance program. One part-time (20 hrs/week) intern assists with energy efficiency and renewable energy programs. Silicon Valley has four full-time equivalent (FTE) staff members contracted to deliver commercial and industrial energy programs. Silicon Valley staff stated that it is possible to meet its targets with its existing staff, but that it will become increasingly difficult as the utility redirects staff to work with other agencies.

The most significant barrier to meeting targets is the irregularity of large custom projects. Most of Silicon Valley's energy savings come from these projects, which often take a year or more to complete. Because these savings are large but infrequent, Silicon Valley may fail to meet its targets in some years but exceed them in others.

Silicon Valley Power has a number of data centers moving into its service territory and has been handling these through its Customer Directed Rebate program. As the data center industry shifts to more energy-efficient facilities, Silicon Valley establishes a Data Center program for new construction that defines baseline energy efficiency before considering rebates.

Silicon Valley reviews its programs annually to make changes as new technologies become cost effective. The utility adjusts or eliminates measures in response to standards, adjusts rebate levels, and updates the deemed savings values of some measures. Silicon Valley eliminated its server virtualization rebate because it felt that the market had transformed and that this was becoming standard practice.

Silicon Valley expects changes to codes and standards to affect its ability to meet its targets because lighting is a significant percentage of its savings. However, Silicon Valley achieves the majority of its savings through custom projects outside the lighting category.

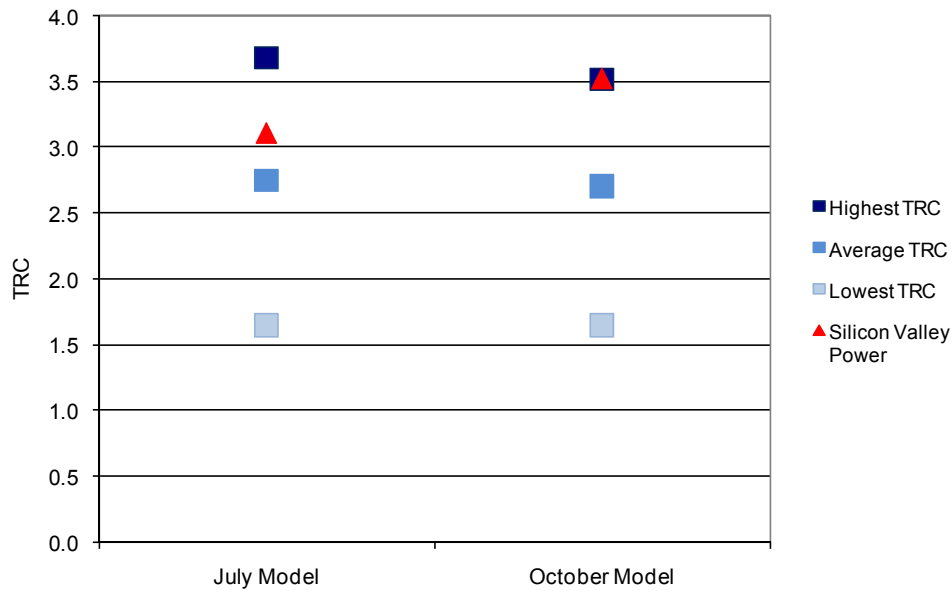
Silicon Valley expects to complete an EM&V study in March 2011.

### Program Cost Effectiveness

Silicon Valley's fiscal year 2008/2009 programs had a TRC ratio of 5.60 (CMUA 2010, Table 7). The CalEERAM model used to set the targets shows a TRC ratio of 3.11. The error in the version of the model used to create this value increases uncertainty in the TRC ratio estimate, so reviewers also looked at the TRC ratio of the market savings potential from the revised CalEERAM, which is 3.52. **Figure 116** shows the two TRC ratios for Silicon Valley as compared with the other utilities. Silicon Valley's October model had the highest TRC ratio of the 12 utilities.

The cost per first-year kWh of savings from Silicon Valley's model was 58 cents for residential and 30 cents for nonresidential in 2015, compared to an average of 58 cents for residential and 36 cents for nonresidential across the POU models studied. Silicon Valley's cost is average for residential and below average for nonresidential.

**Figure 116: Silicon Valley's TRC Ratios From the Two CalEERAM Versions, Compared to Other POUs**

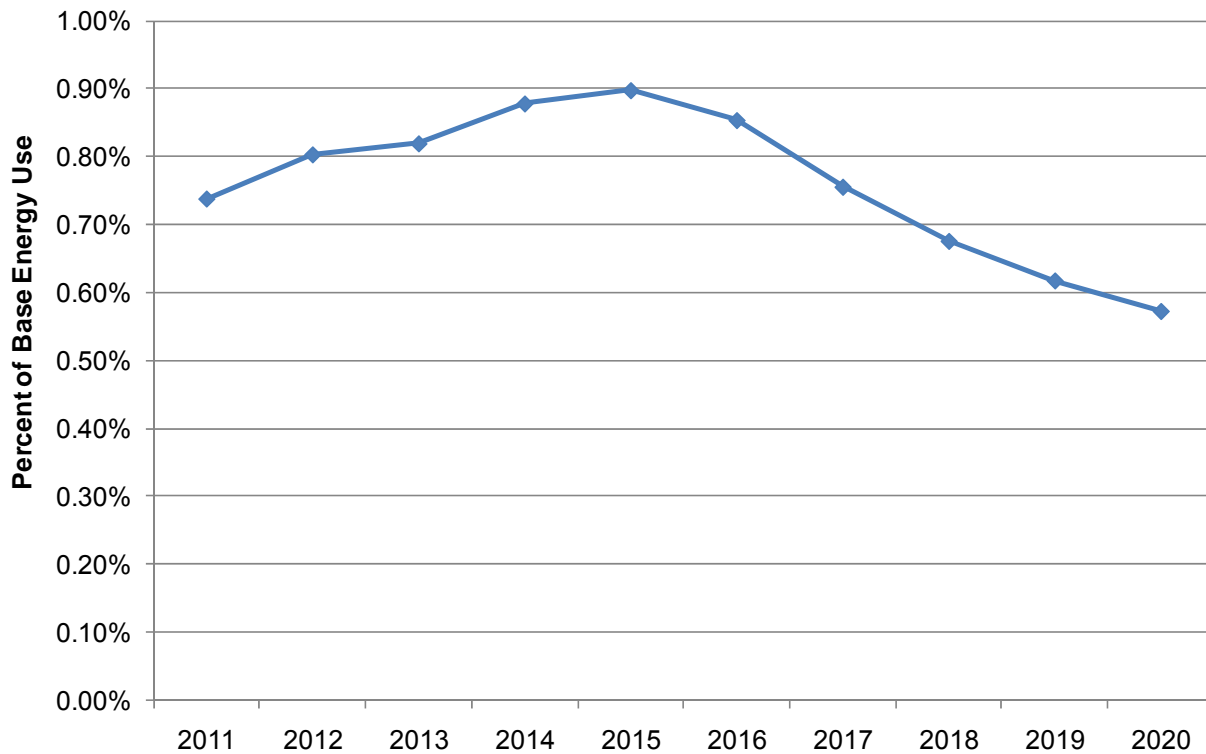


Source: Data obtained from California Energy Efficiency Resource Assessment Model (October 2010) and (July 2010) versions.

### Targets' Contribution to Energy Use Reduction

Meeting its targets through successful programs will reduce Silicon Valley's electricity use over the forecast period. **Figure 117** shows target energy savings as a percentage of total energy use. Cumulatively, the targets add up to 7.3 percent of one year of energy use for 2020 (based on the energy use forecast in the CalEERAM model) and do not meet AB 2021's 10-percent energy use reduction requirement.

**Figure 117: Target Energy Savings as a Percentage of Base Energy Use—Silicon Valley**



Source: Data obtained from California Municipal Utilities Association, *Energy Efficiency in California's Public Power Sector. A Status Report*, March 2010.

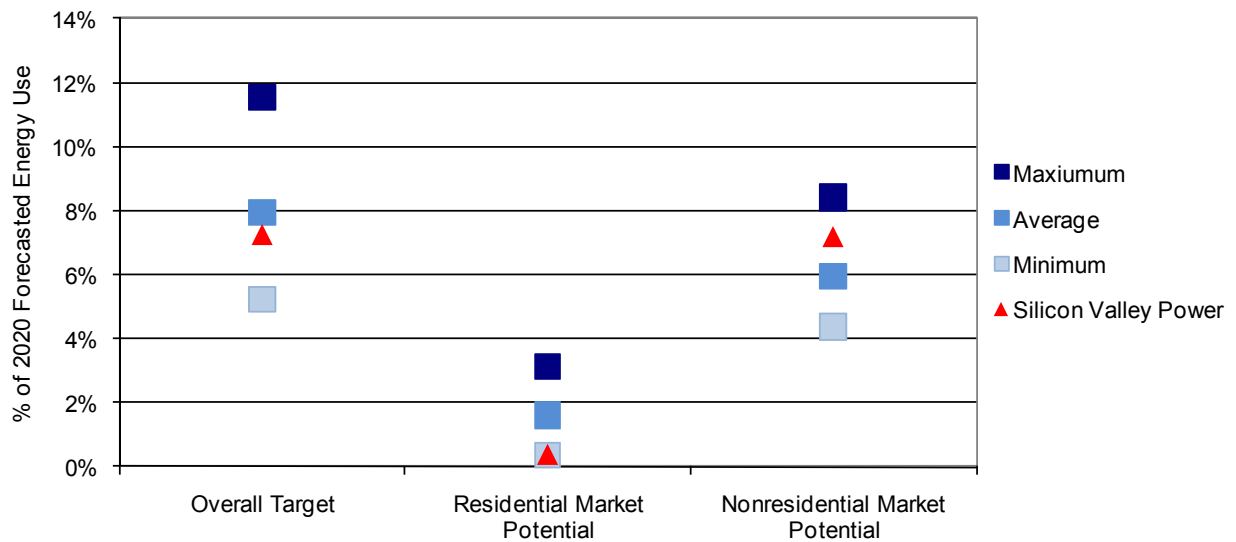
### Assessment of Targets

In this section, KEMA evaluates Silicon Valley's targets by first comparing them with the other 11 POUs, then by evaluating whether they adequately meet AB 2021 requirements (cost-effectiveness, feasibility, reliability, and energy use reduction).

**Figure 118** shows the sum of Silicon Valley's 2011-2020 targets as a percentage of energy use, relative to those of other POUs. The overall target is from the March 2010 CMUA report and represents Silicon Valley's current commitments. Because the CMUA report did not break out targets by sector, **Figure 118** shows the sector breakdowns of market savings potentials from the October 2010 CalEERAM revision.

Silicon Valley's target is below average for the 12 utilities. Silicon Valley's residential market savings potential is the lowest of the 12, and its nonresidential savings potential is above average.

**Figure 118: Silicon Valley's Targets, Compared With the 12 POUs**



Source: Data obtained from California Municipal Utilities Association, *Energy Efficiency in California's Public Power Sector. A Status Report*, March 2010, combined with California Energy Efficiency Resource Assessment Models (October 2010).

### *Summary of Target Adequacy*

In this section KEMA examines the adopted targets across all four AB 2021 target assessment criteria.

Table 28 summarizes the findings. Silicon Valley’s targets meet all criteria except one: the energy use reduction target.

**Table 28: Target Assessment—Silicon Valley**

<b>Target Criterion</b>	<b>Criteria Description</b>	<b>How Well Does It Meet This Criterion?</b>
Cost Effectiveness	TRC ratio $\geq 1$	TRC ratio = 3.52
Feasibility	<ul style="list-style-type: none"> <li>Revised targets are reasonably related to reported savings (2006-2009)?</li> <li>Revised targets are reasonably related to market savings potential?</li> <li>Annual ramp-up rate in future years is reasonable?</li> <li>Budget and staffing is likely to be in place to achieve targets?</li> </ul>	<p>Targets are in line with 2008-2009 reported savings.</p> <p>Even though targets are higher than market savings potential for some years, cumulative market savings potential is higher than cumulative targets, and targets should be feasible.</p> <p>Ramp-up 2012-2015 is moderate.</p> <p>Based on past reported savings, targets should be achievable with existing budget and staffing.</p>
Reliability	<ul style="list-style-type: none"> <li>Successfully achieved 2007 targets in most years?</li> <li>Utility performs regular EM&amp;V?</li> </ul>	<p>SVP achieved its 2009 targets and fell only slightly short in 2008.</p> <p>SVP completed third party EM&amp;V impact studies of its 2008 and 2009 programs.</p>
Energy Use Reduction	<ul style="list-style-type: none"> <li>Meets 10% reduction over 10 years?</li> </ul>	Current targets reach 7.3% of 2020 forecast energy use over 10 years

### Options for Increasing Efficiency

KEMA altered the inputs to Silicon Valley's model to see what changes would be required for the market savings potential to meet the AB 2021 requirement to reduce energy use over 10 years. KEMA increased Silicon Valley's incentive levels incrementally until market savings potential reached 10 percent over 10 years. Setting incentives at 67 percent of incremental measure cost produced a 10 percent cumulative savings over 10 years, with an overall TRC ratio of 3.25 and a 2011 cost of 36 cents per first-year kWh (increasing to 58 cents per kWh by 2020).

By comparison, Silicon Valley's existing program has an overall TRC ratio of 5.60 and cost about 17 cents per kWh in fiscal year 2008/2009.<sup>48</sup>

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<sup>48</sup> Calculated from program data in CMUA (2010), Table 7.

## Truckee Donner

### Summary of Revised Targets

Efficiency savings for Truckee Donner Public Utility District (Truckee) in fiscal year 2008/2009 represented 0.6 percent of all POU (including SMUD and LADWP) energy efficiency savings (CMUA 2010). Truckee's 2007 targets were significantly higher than its 2006 program savings. Although its savings fell short of its 2007 target, by 2008 and 2009 Truckee exceeded its targets, set in 2007. Truckee's new targets for 2011 and 2012 are higher than those set in 2007 but lower than reported savings for 2008 and 2009. The targets increase slowly over the forecast period. The cumulative targets are close to the cumulative market savings potential throughout the forecast period, but annual targets are higher than market savings potential in the early years and lower in later years. The cumulative total of the program savings targets from 2011 to 2020 are equivalent to 10.4 percent of forecasted electricity use for 2020.

### Key Analytical Differences From Other Utilities

Truckee's CalEERAM model contained a number of key differences from most of the other utilities. This will help to explain differences in the resulting technical, economic, and market savings potential estimates.

- Truckee set targets that are different from its March 2010 market savings potential. The targets result in similar cumulative savings but shift those savings over time to be higher than market savings potential in some years and lower in others.
- Truckee does not model any industrial savings (floor space is blank on the worksheet that calculates industrial savings).
- Truckee is the only utility among the 12 with a winter peak.
- Truckee is the only utility among the 12 that modeled heating savings for ground-source heat pumps. (See **Table 29**.)
- Truckee excluded several measures from its analysis of economic and market savings potential. **Table 29** shows these measures.

**Table 29: Measures Explicitly Excluded or Included in Analysis—Truckee**

	Residential	Commercial	Industrial
Exclusions	Pool pumps Radiant barriers Refrigerant charge Shade trees	Packaged terminal air-conditioner (< 7kbtuh) Package system A/C (< 5.4 tons, 14 SEER) Chillers Refrigerant charge Anti-sweat heat controls	Compressed air
Inclusions	Ground-source heat pump (heating and cooling)	Ground-source heat pump (heating and cooling)	None

Source: Data obtained from California Energy Efficiency Resource Assessment Model (July 2010).

- Truckee was one of only three of the 12 utilities to deviate from 50 percent incentives for its residential program scenario. **Table 30** shows the scenario incentive levels that were submitted to the Energy Commission, expressed as a percentage of incremental cost. Truckee's commercial incentives were set to 50 percent, which is similar to most of the other POUs.

**Table 30: Residential Scenario Incentives, Percentage of Incremental Cost—Truckee**

Residential Incentives	
Lighting	25%
Water Heating	50%
Appliances	25%
HVAC/Shell	25%

Source: Analysis based on California Energy Efficiency Resource Assessment Model (July 2010).

## Technical and Economic Savings Potential

**Figure 119** (energy) and **Figure 120** (demand) show the technical and economic savings potential in Truckee's revised July 2010 CalEERAM model. Savings dip slightly in 2012 due to new federal lighting standards that will improve the efficiency of baseline lighting and reduce the savings potential for CFLs. Savings then climb through the end of the forecast, averaging 3.8 percent growth per year.

Truckee has a much larger gap between its technical and economic savings potentials than any of the 12 utilities, except for Roseville. This is due to Truckee's exclusions. (See **Table 29**.) Because these measures are included in technical but excluded from economic savings potential, economic savings potential is significantly lower than technical savings potential compared to other utilities.

Truckee has the highest technical savings potential (as a percentage of energy use) of the 12 utilities in the detailed study. Ground-source heat pumps account for 35 percent of Truckee's residential technical savings potential and 9 percent of nonresidential technical savings potential. Unlike the other utilities, Truckee has a winter peak and includes heating savings in its ground-source heat pump calculations. (The other utilities used cooling savings only.) The measure was cost-effective and therefore included in the economic and market savings potential analysis. This single factor seems to explain Truckee's high technical and economic savings potentials. When reviewers explicitly excluded ground-source heat pumps from Truckee's analysis, economic savings potential dropped from 46 percent to 32 percent of energy use, a value in line with most of the other utilities.

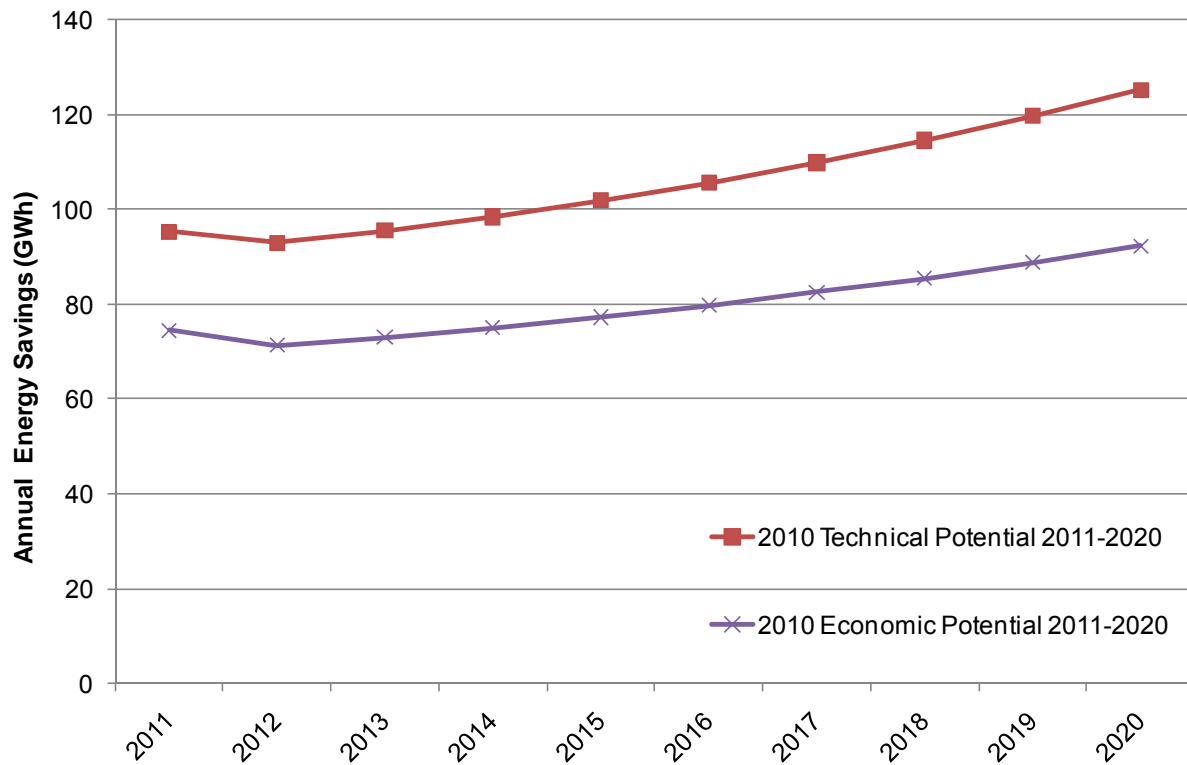
Is the high potential estimate for ground-source heat pumps reasonable for Truckee? According to Truckee utility staff, only 5 to 10 percent of homes and less than 5 percent of commercial buildings use electricity as primary heating fuel.<sup>49</sup> The model assumes a 50 percent electric fuel

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<sup>49</sup> Personal communication, February 22, 2011, via e-mail.

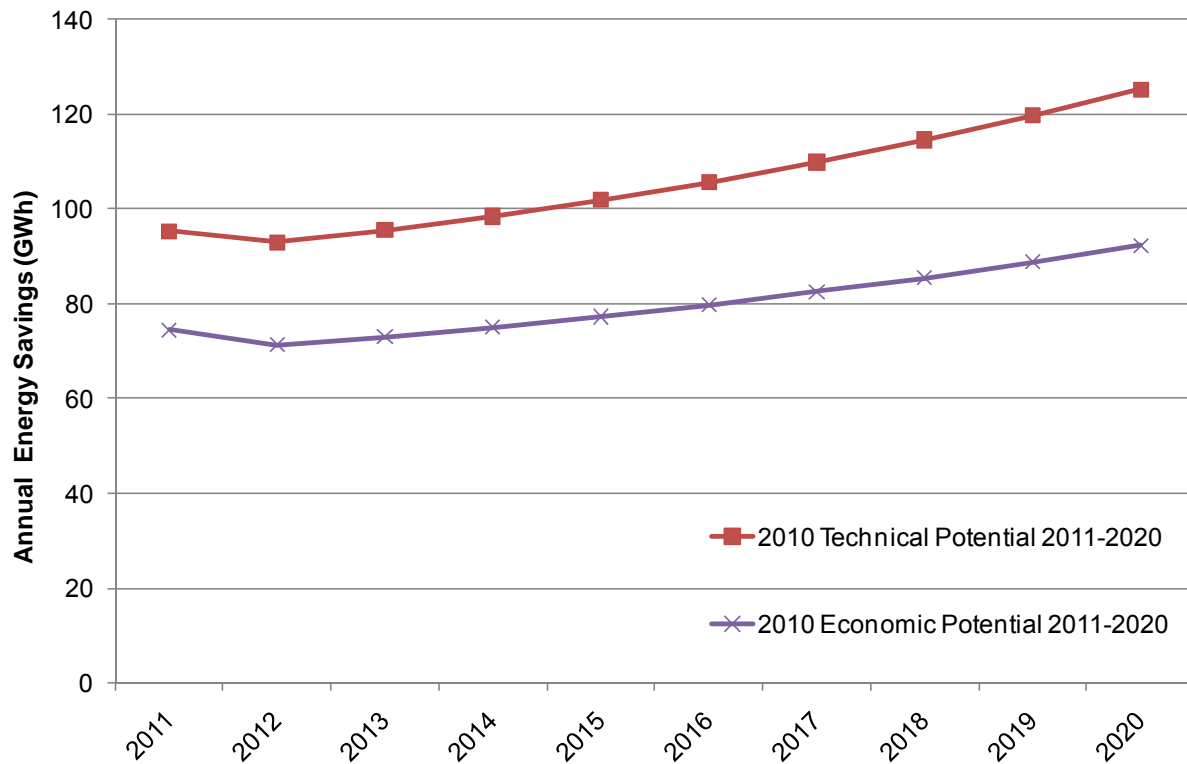
share for residential ground-source heat pumps and 10 percent for commercial, suggesting that the potential (technical, economic and market) may be significantly overstated.

**Figure 119: Technical and Economical Energy Savings Potential (MWh)—Truckee**



Source: Data obtained from California Energy Efficiency Resource Assessment Model (July 2010).

**Figure 120: Technical and Economic Demand Savings Potential (MW)—Truckee**



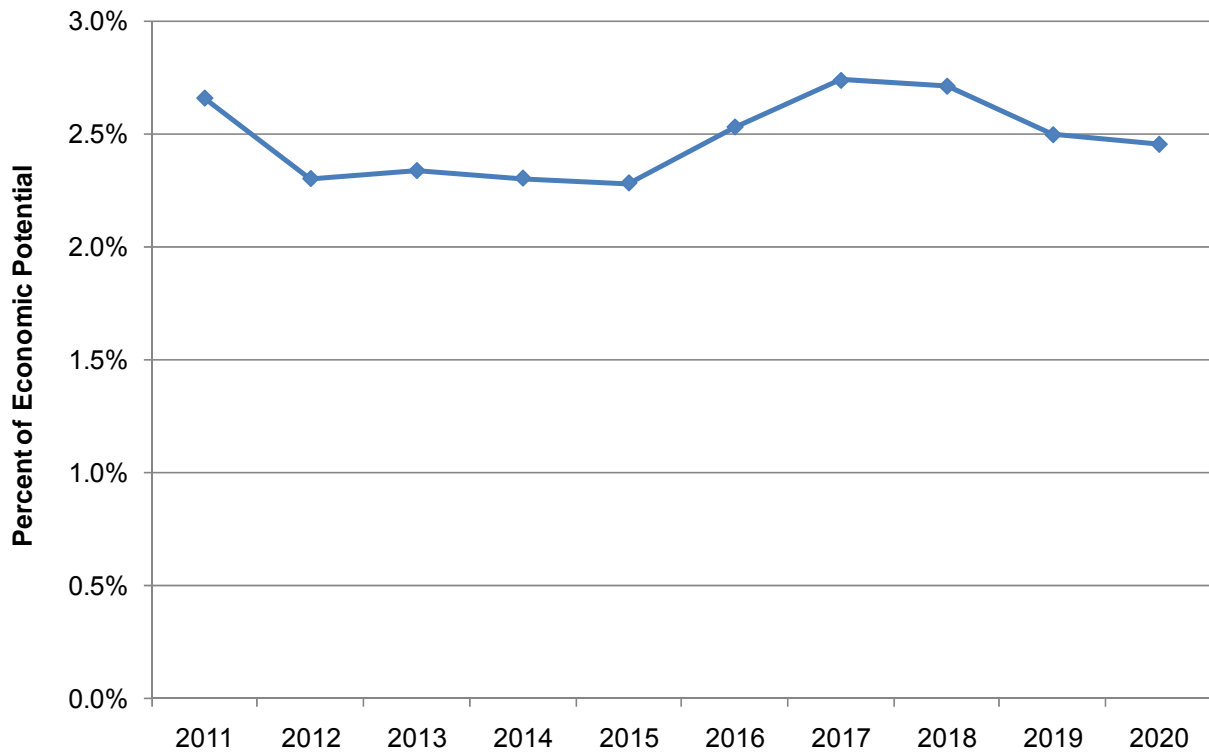
Source: Data obtained from California Energy Efficiency Resource Assessment Model (July 2010).

## Market Savings Potential and Targets

**Figure 121** shows Truckee’s energy savings targets as a percentage of economic savings potential. Truckee’s targets are quite flat compared with the other utilities.

Because of KEMA’s concerns about ground-source heat pumps, reviewers reran the model using Truckee’s reported saturations of electric heat in place of the assumptions in CalEERAM. Residential electric heating share was reduced from 50 percent to 8 percent (Truckee reported 5 to 10 percent of residential customers heat with electricity), and commercial electric heating share was reduced from 10 percent to 5 percent. Truckee’s market savings potential fell by 4.3 percent, a much smaller decrease than either technical or economic savings potential (18 percent and 25 percent, respectively). The change pushed down Truckee’s cumulative market savings potential to 9.7 percent over 10 years, still (only slightly) short of AB 2021’s 10 percent reduction requirement.

**Figure 121: Target Energy Savings as a Percentage of Economic Savings Potential—Truckee**

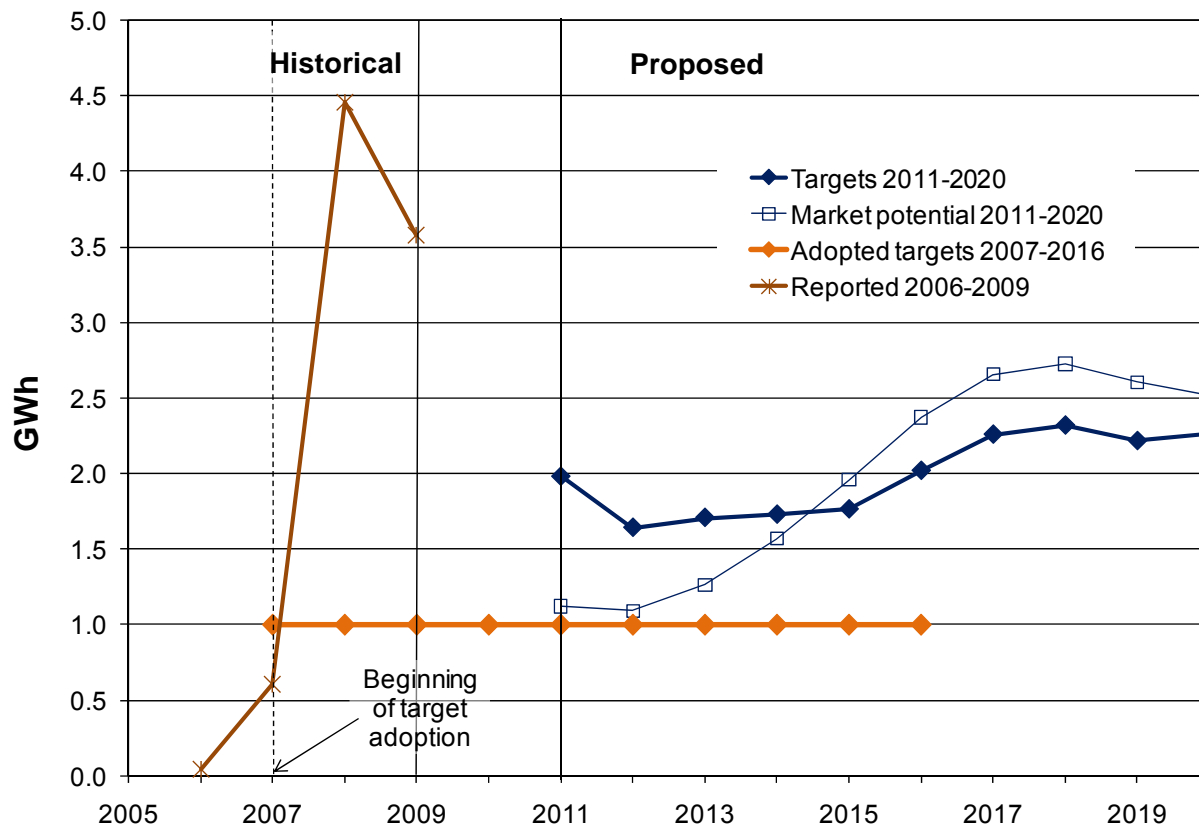


Source: Data obtained from California Municipal Utilities Association, *Energy Efficiency in California's Public Power Sector. A Status Report*, March 2010, combined with California Energy Efficiency Resource Assessment Models (July 2010).

**Figure 122** shows Truckee's new targets for 2011 to 2020 as compared with previous targets, past program savings, and recent estimates of market savings potential. Truckee's revised 2010 targets are notably higher than older targets set even as recently as 2011 and increase only slightly over the forecast period. The targets are lower than reported 2008 and 2009 savings.

The ramp-up rate in Truckee's targets is quite modest compared with other utilities, with an annualized growth of about 2.3 percent between 2012 and 2018, when savings peak.

**Figure 122: Truckee's Historical Annual Energy Efficiency Program Savings and Targets**



Source: Data for 2011-2020 targets obtained from California Municipal Utilities Association, *Energy Efficiency in California's Public Power Sector. A Status Report*, March 2010. Data for 2011-2020 market potential obtained from California Energy Efficiency Resource Assessment Models (July 2010). Data for 2009 reported savings obtained from California Municipal Utilities Association, *Energy Efficiency in California's Public Power Sector. A Status Report*, March 2009. Data for 2007-2016 targets obtained from California Municipal Utilities Association, *Establishing Energy Efficiency Targets: A Public Power Response to AB2021. Final Update*. October 2007.

Truckee's market savings potentials vary widely from 2011 to 2020 and more than double between 2012 and 2018. Truckee's 2011-2020 targets even out the savings pattern, with targets higher than market savings potentials in the early years and lower in later years. Over the 10-year period, cumulative targets are very close to cumulative market savings potential. By aggressively pursuing retrofit opportunities in the early years, Truckee can probably meet its goals, even though the targets are higher than the market savings potentials in the early years.

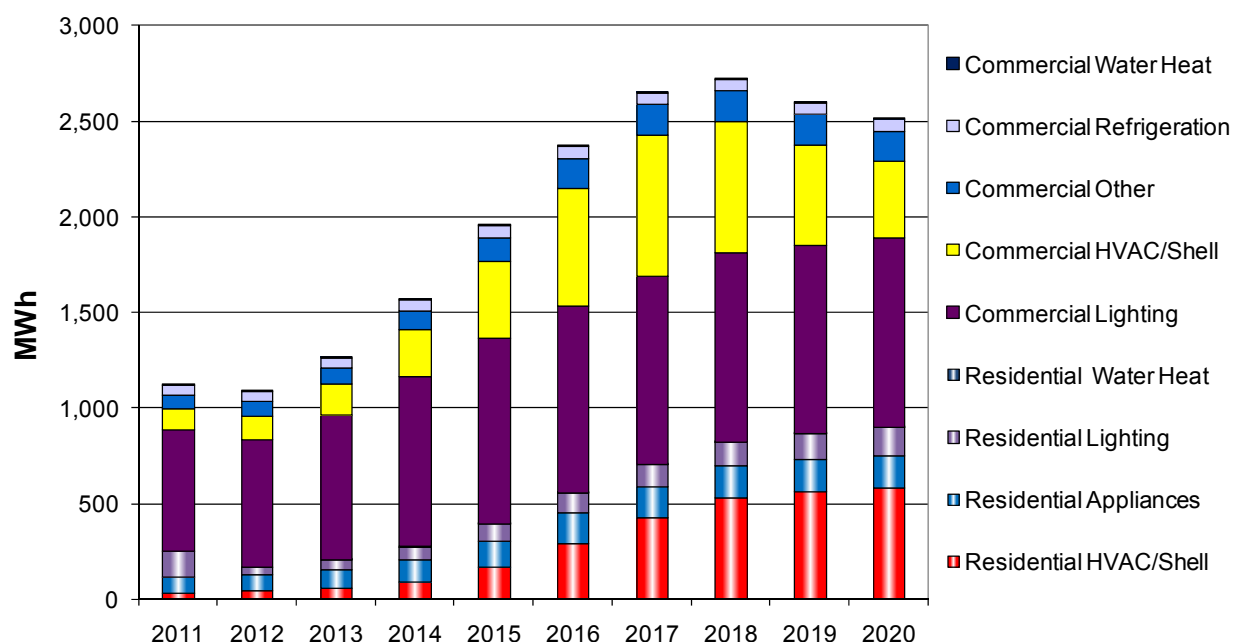
The nonresidential sector drives the decline in market savings potential after 2015. Awareness for most nonresidential measures reaches 100 percent by 2017; without increasing awareness, a decline in potential participants drives the savings. (The more customers adopt high-efficiency measures, the smaller the pool of potential participants.)

Truckee exceeded its target in 2008 and 2009, after falling short in 2007. This success indicates that Truckee can probably meet its targets with its current programs.

### Market Savings Potential by End Use

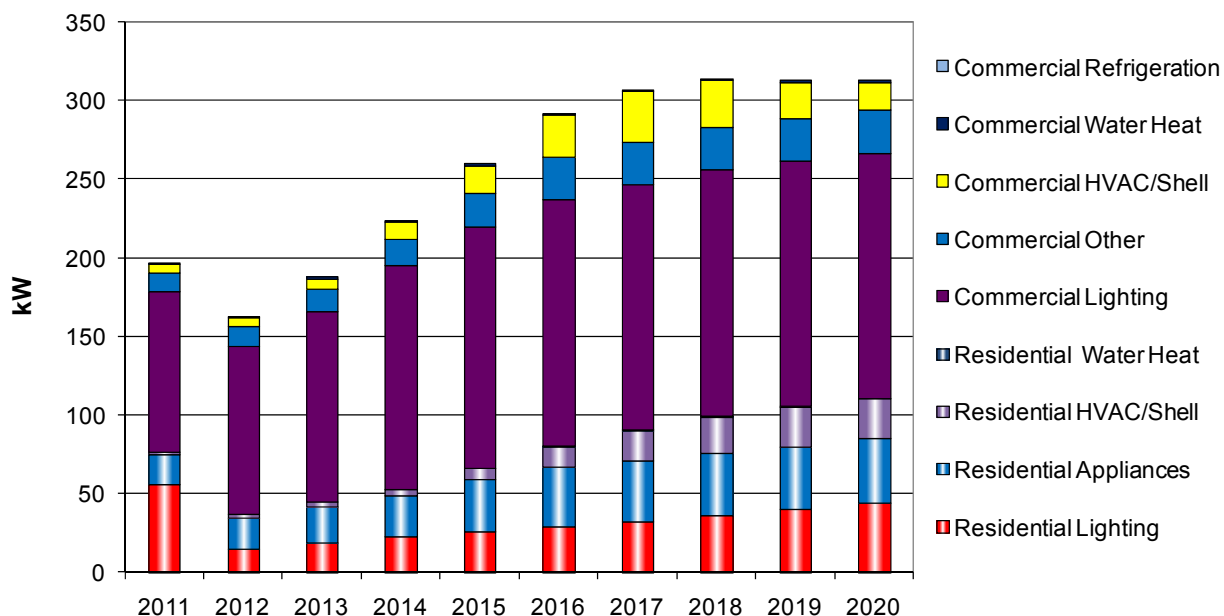
KEMA used revised 2010 CalEERAM data to break out market savings potential to show opportunities for specific programs by both customer sector and end-use category. **Figure 123** and **Figure 124** show market energy and peak demand savings potential, respectively, by sector and end use. Commercial lighting is the largest contributor to market energy savings potential. Residential HVAC/shell and commercial HVAC/shell also contribute significantly to energy savings, although their relative importance varies over the forecast period. Commercial lighting is the most significant contributor to market peak demand savings potential.

**Figure 123: Truckee's Market Savings Potential (MWh) by End Use**



Source: Data obtained from California Energy Efficiency Resource Assessment Model (July 2010).

**Figure 124: Truckee's Market Savings Potential (kW) by End Use**



Source: Data obtained from California Energy Efficiency Resource Assessment Model (July 2010).

### Program Factors Affecting Target Feasibility and Reliability

Truckee currently spends about 4.5 percent of its gross electric sales on energy efficiency. Energy efficiency is first in Truckee's resource plan loading order. Its efficiency planning is done on a 5 to 10-year horizon. It operates on a two-year budget cycle and is currently in its 2010-2011 cycle. (Truckee operates on the calendar year.)

Truckee's electricity use is 88 percent residential and is a winter weekends-and-holidays peaking utility.

Truckee uses the transmission services of NV Energy. Truckee does not receive its electric resources using the California Independent System Operator (California ISO) power grid and the Cal ISO does not control its electricity. It purchases electricity from other utilities in the Western Electricity Coordinating Council, which coordinates electric load in the 11 western states.

Truckee's conservation department consists of a public information and conservation manager, a conservation program administrator, and a conservation customer service representative. Since the conservation department covers both energy and water conservation, these staff members do not work full time on energy efficiency. Truckee currently has slightly fewer than two full-time staff dedicated to energy efficiency. Truckee's staff members have an average of 20 years professional experience, with varying levels of direct energy efficiency experience.

Truckee staff members stated that they have adequately staff to achieve their targets. They added that the biggest impediment to their success is the ever-increasing time they devote to

regulatory reporting and responding to a steady stream of information requests from regulatory, legislative, and other representatives.

Potential barriers to achieving targets include the possibility of new regulatory costs. Truckee staff cited efforts by California's investor-owned utilities to include POUs within the jurisdiction of the California Public Utilities Commission, as well as increased budget pressure from economic problems. Truckee also sees customer acceptance and willingness to implement energy efficiency measures, both behavioral and economic, as limiting factors.

Residential screw-in CFLs have largely dominated Truckee's past savings. Truckee has almost no cooling load and no large industrial load. Truckee has many programs that serve its business customers (mostly lodging, retail, restaurants, and some larger agencies and businesses). Commercial lighting and refrigeration tend to account for these customers' savings. Truckee also assists with improving the energy efficiency of customers' building envelopes (that is, the walls, floors, and ceilings that separate the conditioned space from the exterior environment). Most of these savings go to Southwest Gas, the local gas utility, which limits the measure's value for Truckee.

Truckee anticipates uncertainty around lighting standards to affect its residential CFL programs. The utility is therefore investigating other lighting technologies (LEDs, for example) and expanding its business programs (commercial lighting, refrigeration, and motors). It is also considering a program for residential motors.

Truckee staff believes it is close to saturating the 60-watt equivalent spiral CFL market. It has shifted its programs into five other types of residential CFLs: 100-watt equivalent spiral, 50-watt equivalent R20, 65-watt equivalent R30 standard and dimmable, 120-watt equivalent PAR38, and 40-watt equivalent G25 globe. Truckee's LED holiday light exchange program has been very successful.

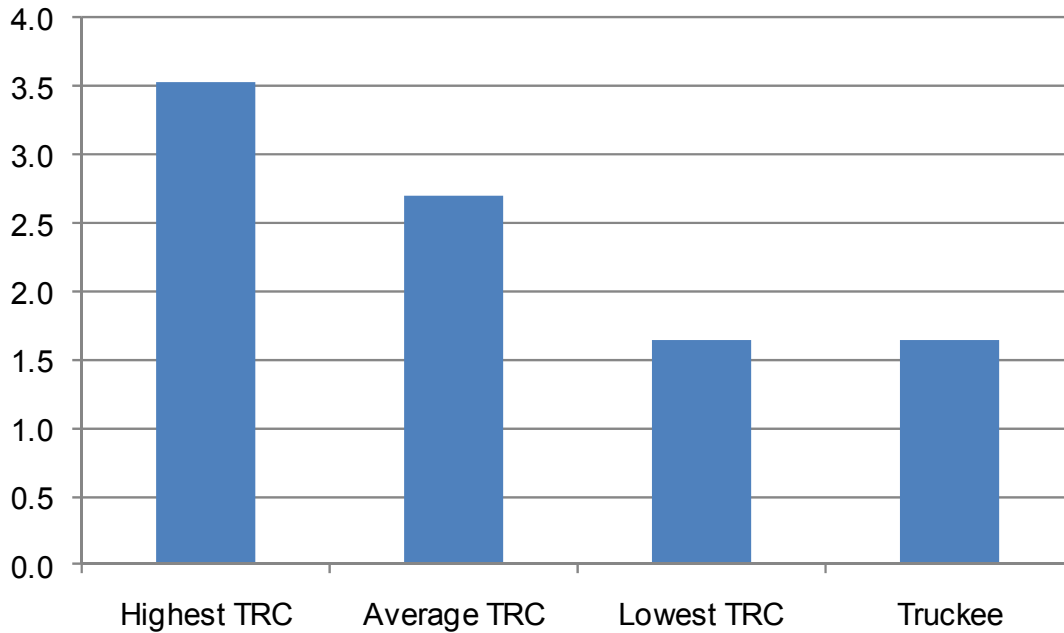
Truckee expects to finalize its EM&V study of 2010 programs by spring 2011.

### Program Cost Effectiveness

Truckee's fiscal year 2008/2009 programs had a TRC ratio of 5.06 (CMUA 2010, Table 7). The CalEERAM model used to set the targets shows a TRC ratio of 1.64. **Figure 125** shows Truckee's TRC ratio compared with the other utilities. Truckee's TRC ratio is the lowest of all the utilities for the program modeled.

In 2015, the cost per first-year kWh of savings from Truckee's model was 61 cents for residential and 59 cents for nonresidential, as compared with an average of 58 cents for residential and 36 cents for nonresidential across the other POU models. Truckee's cost is slightly above average for residential, but its nonresidential cost is the highest of all the utilities studied.

**Figure 125: Truckee's TRC Ratio From Its CalEERAM Model, Compared to Other POUs**

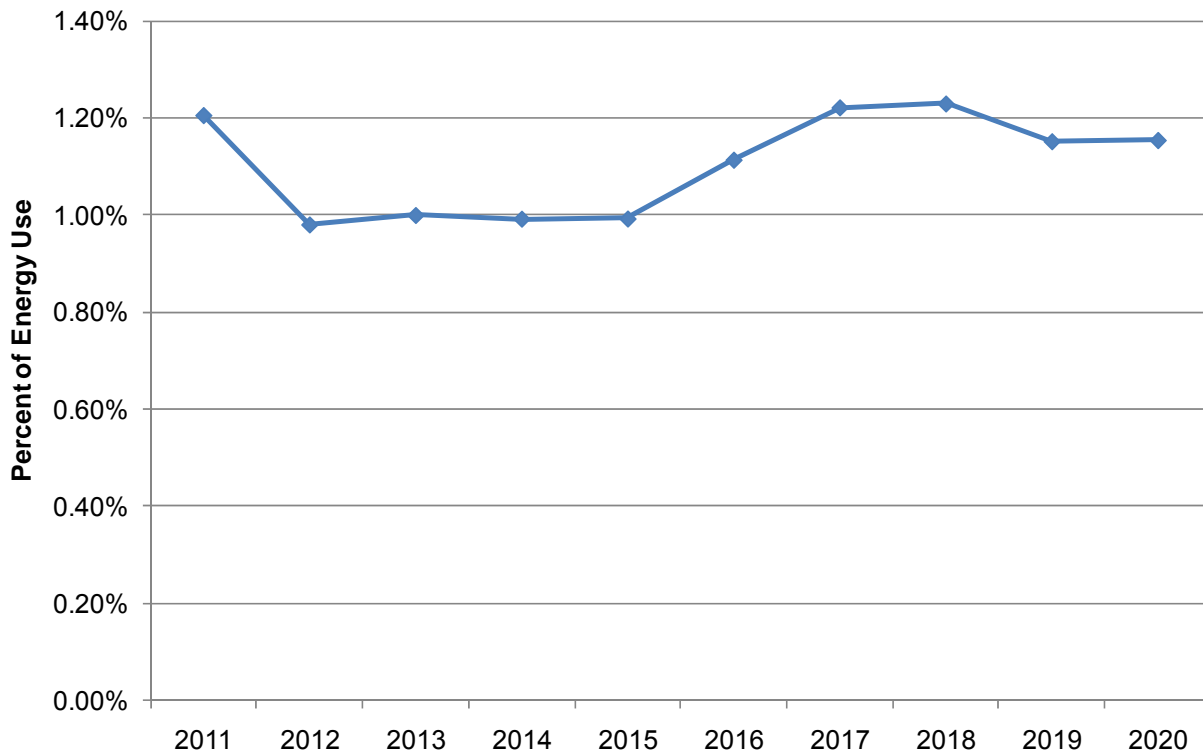


Source: Data obtained from California Energy Efficiency Resource Assessment Model (October 2010) and (July 2010) versions. TRC ratio for Truckee is from the July 2010 model; TRC ratios for the other 11 utilities are taken from the October model revisions.

### Targets' Contribution to Energy Use Reduction

Successfully meeting the targets in its programs will reduce Truckee's electricity use over the forecast period. **Figure 126** shows target energy savings as a percentage of total energy use. Cumulatively, the targets add up to 10.4 percent of forecasted energy use for 2020 (based on the energy use forecast in the CalEERAM model), which exceed AB 2021's 10 percent reduction requirement.

**Figure 126: Target Energy Savings as a Percentage of Base Energy Use—Truckee**



Source: Data obtained from California Municipal Utilities Association, *Energy Efficiency in California's Public Power Sector. A Status Report*, March 2010.

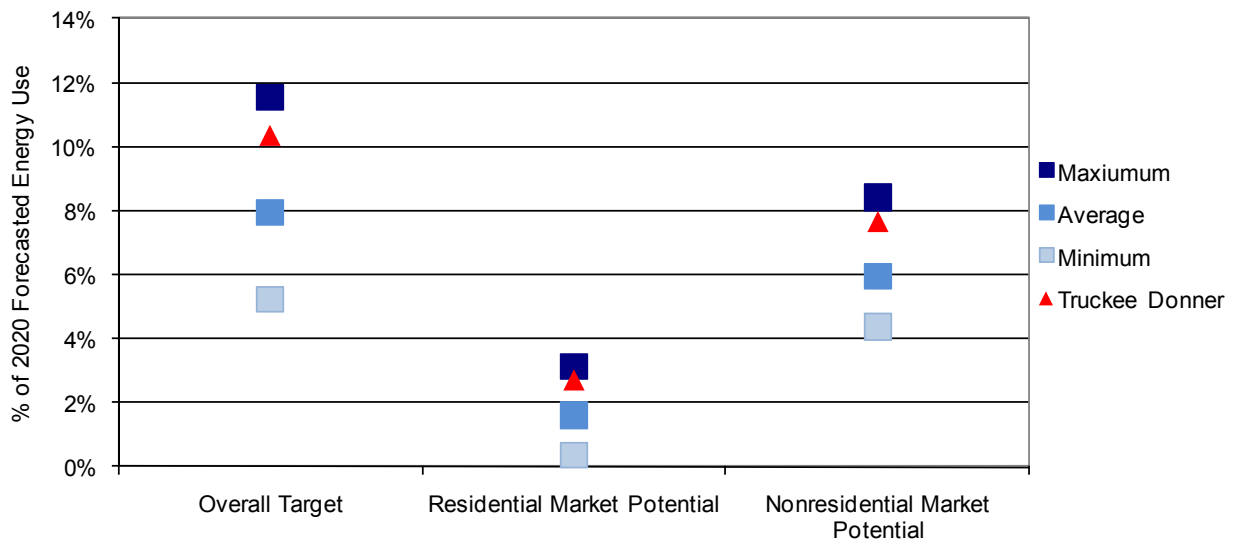
### Assessment of Targets

In this section, KEMA evaluates Truckee's targets by first comparing them with the other 11 POUs, then evaluating whether they adequately meet AB 2021's requirements (cost-effectiveness, feasibility, reliability, and energy use reduction).

**Figure 127** shows the sum of Truckee's 2011-2020 targets as a percentage of energy use, relative to those of other POUs. The overall target is from the March 2010 CMUA report and represents Truckee's current commitments. Because the CMUA report did not break out targets by sector, **Figure 127** shows the sector breakdowns of market savings potentials from the October 2010 CalEERAM revision.

Truckee's target is among the highest of the 12 utilities in the detailed study. Truckee's residential and nonresidential market savings potentials are also among the highest, although market savings potentials are lower than targets.

**Figure 127: Truckee's Targets in Context of 12 of the Largest POUs**



Source: Data obtained from California Municipal Utilities Association, *Energy Efficiency in California's Public Power Sector. A Status Report*, March 2010, combined with California Energy Efficiency Resource Assessment Models (October 2010 and July 2010 versions).

### *Summary of Target Adequacy*

In this section KEMA examines adopted targets across all four AB 2021 target assessment criteria. **Table 31** summarizes the findings. Truckee's targets meet all of the criteria except one: feasibility. Truckee's targets are significantly higher than the estimated market savings potential. While this finding does raise concern, Truckee's actual 2009 savings exceeded its 2011 market savings potential, indicating that the targets may not be as much of a stretch as the market savings potential suggests.

**Table 31: Target Assessment—Truckee**

Target Criterion	Criteria Description	How Well Does It Meet This Criterion?
Cost Effectiveness	TRC ratio $\geq 1$	TRC ratio = 1.64
Feasibility	<ul style="list-style-type: none"> <li>Revised targets are reasonably related to reported savings (2006-2009)?</li> <li>Revised targets are reasonably related to market savings potential?</li> <li>Annual ramp-up rate in future years is reasonable?</li> <li>Budget and staffing is likely to be in place to achieve targets?</li> </ul>	<p>Targets are lower than 2008-2009 reported savings.</p> <p>Cumulative targets are consistent with cumulative market savings potential. However, market savings potential may be overstated.</p> <p>Ramp-up 2012-2015 is modest and should be achievable with current budget and staffing.</p> <p>Based on 2008 and 2009 reported savings, budget and staffing are adequate to meet targets.</p>
Reliability	<ul style="list-style-type: none"> <li>Successfully achieved 2007 targets in most years?</li> <li>Utility performs regular EM&amp;V?</li> </ul>	<p>Truckee exceeded its 2008 and 2009 targets.</p> <p>Truckee completed third party EM&amp;V impact studies of its 2008 and 2009 programs.</p>
Energy Use Reduction	<ul style="list-style-type: none"> <li>Meets 10% reduction over 10 years?</li> </ul>	Current targets reach 10.4% of base use over 10 years.

### Options for Increasing Efficiency

Truckee's targets already meet AB 2021's 10-percent-over-10-years requirement. Although, over time, the targets did not match the market savings potentials in the CalEERAM model, the cumulative target and market savings potentials were very close. The market savings potentials also met their targets.

KEMA reran the model using the lower electric heating shares for ground-source heat pumps and discovered that cumulative market savings potentials reached only 9.7 percent. KEMA then added Truckee's exclusions back in and increased incentive levels until the cumulative market savings potential reached 10 percent. Starting with Truckee's original incentive levels (see **Table 30**), KEMA finally increased the incentives on lighting, appliances, and HVAC/shell from 25 percent to 30 percent, which produced a 10 percent cumulative market savings potential. The overall TRC ratio for the modeled program was 1.98 and 2011 program costs were 28 cents per first-year kWh (increasing to 46 cents per kWh by 2020). By comparison, Truckee's existing program has an overall TRC ratio of 5.06 and cost about 16 cents per kWh in fiscal year 2008/2009.<sup>50</sup>

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<sup>50</sup> Calculated from program data in CMUA (2010), Table 7.

## Turlock Irrigation District

### Summary of Revised Targets

Efficiency savings for Turlock Irrigation District's (Turlock's) fiscal year 2008/2009 represented 2 percent of all POU (including SMUD and LADWP) energy efficiency savings (CMUA 2010). Turlock's 2007 targets were modest compared with its 2006 reported savings, but the utility's targets increased aggressively between 2009 and 2010. Turlock met its targets in 2007, 2008, and 2009. Turlock's new targets for 2011 to 2013 are comparable to its 2009 reported savings. The targets increase from 2012 to 2016, then decline through 2020. Cumulative targets are in line with cumulative market savings potential. The cumulative total of the program savings targets from 2011 to 2020 are equivalent to 6.8 percent of forecasted electricity use for 2020.

### Key Analytical Differences From Other Utilities

Turlock's CalEERAM model had a few key differences from the other 11 POUs.

- Turlock was one of two utilities to use a different avoided cost forecast. Unlike most of the other utilities, Turlock's avoided costs increase over the entire forecast period. (See **Figure 19.**)
- Turlock was one of only 3 of the 12 utilities that did not adopt 50 percent incentives for their residential program scenarios. **Table 32** shows the incentive levels used for the scenario Turlock submitted to the Energy Commission, expressed as a percentage of incremental cost. Turlock's commercial incentives were set at 50 percent, like most of the other POUs.

**Table 32: Residential Scenario Incentives, Percentage of Incremental Cost—Turlock**

	Residential Incentive s
Lighting	50%
Water Heating	50%
Appliances	100%
HVAC/Shell	50%

Source: Analysis based on California Energy Efficiency Resource Assessment Models (October 2010). Analysis

- Turlock had a lower administrative cost factor (\$/kWh) for many end uses; **Table 33** shows these cost factors.

**Table 33: Comparison of Turlock's Administrative Costs to Typical Administrative Costs**

	Typical Admin Costs (\$/kWh)	Turlock's Admin Costs (\$/kWh)
<b>Residential</b>		
Lighting	\$0.07	\$0.03
Water Heat	\$0.07	\$0.06
Appliances	\$0.07	\$0.06
HVAC/Shell	\$0.07	\$0.06
<b>Nonresidential</b>		
Lighting	\$0.06	\$0.05
Water Heat	\$0.06	\$0.06
Refrigeration	\$0.06	\$0.06
HVAC/Shell	\$0.06	\$0.06
Other	\$0.06	\$0.06

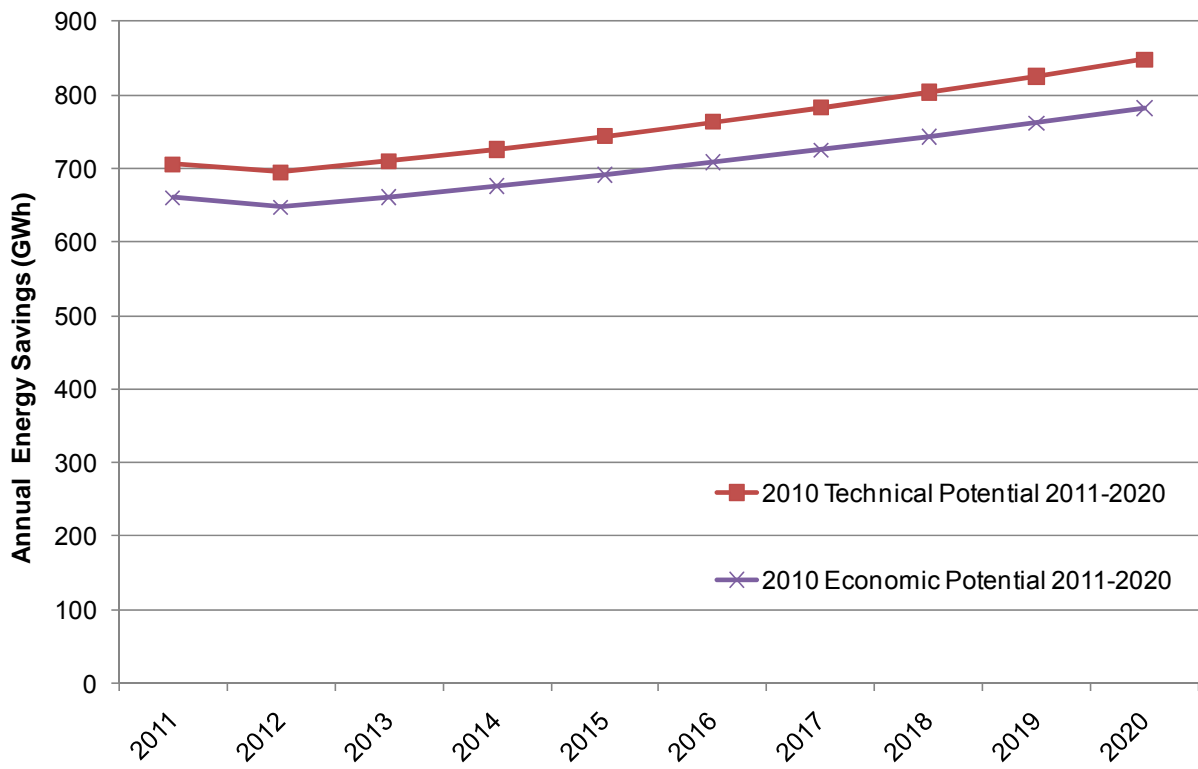
Source: Analysis based on California Energy Efficiency Resource Assessment Models (October 2010). Analysis

- Turlock excluded package system A/C ( $\geq 63.3$  tons, 10.2 EER) for miscellaneous buildings from its analysis.

### Technical and Economic Savings Potential

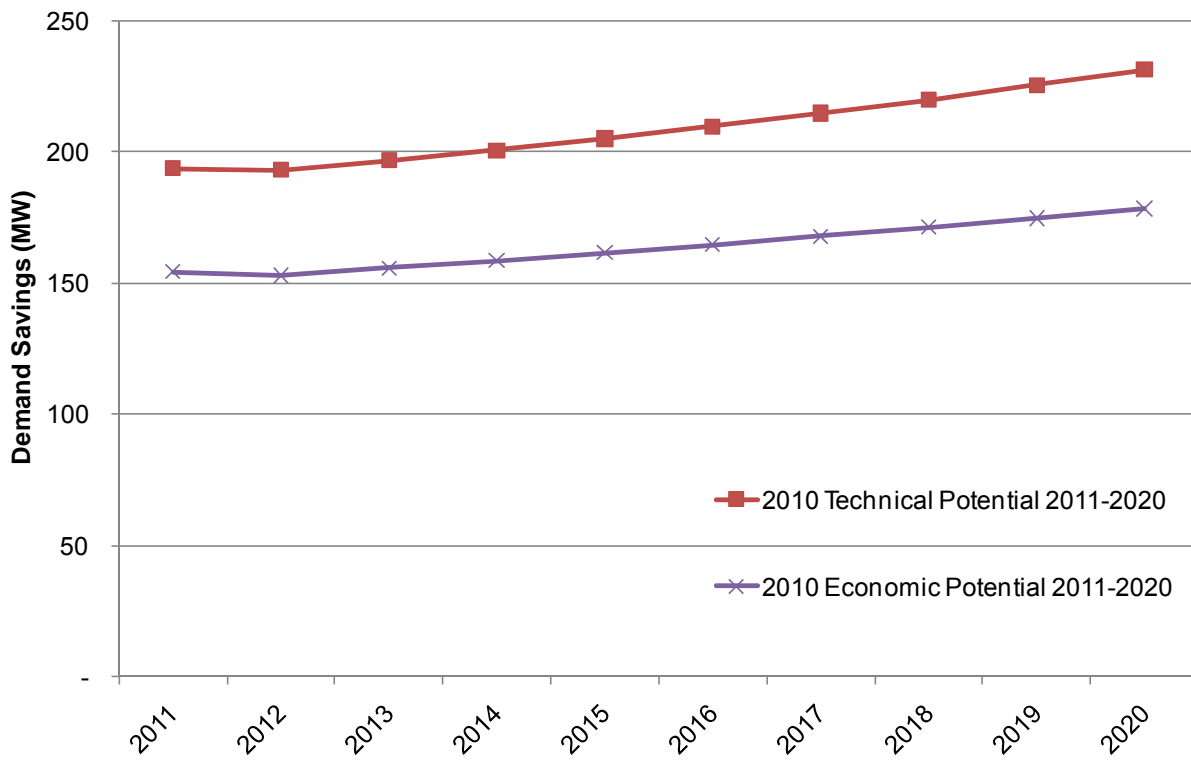
**Figure 128** (energy) and **Figure 129** (demand) show Turlock's technical and economic savings potential, as developed in its revised October 2010 CalEERAM model. Savings dip slightly in 2012 due to new federal lighting standards that will improve the efficiency of baseline lighting and reduce the savings potential for CFLs. Savings then climb through the end of the forecast, and average 2.5 percent growth per year.

**Figure 128: Technical and Economical Energy Savings Potential (MWh)—Turlock**



Source: Data obtained from California Energy Efficiency Resource Assessment Model (October 2010).

**Figure 129: Technical and Economic Demand Savings Potential (MW)—Turlock**

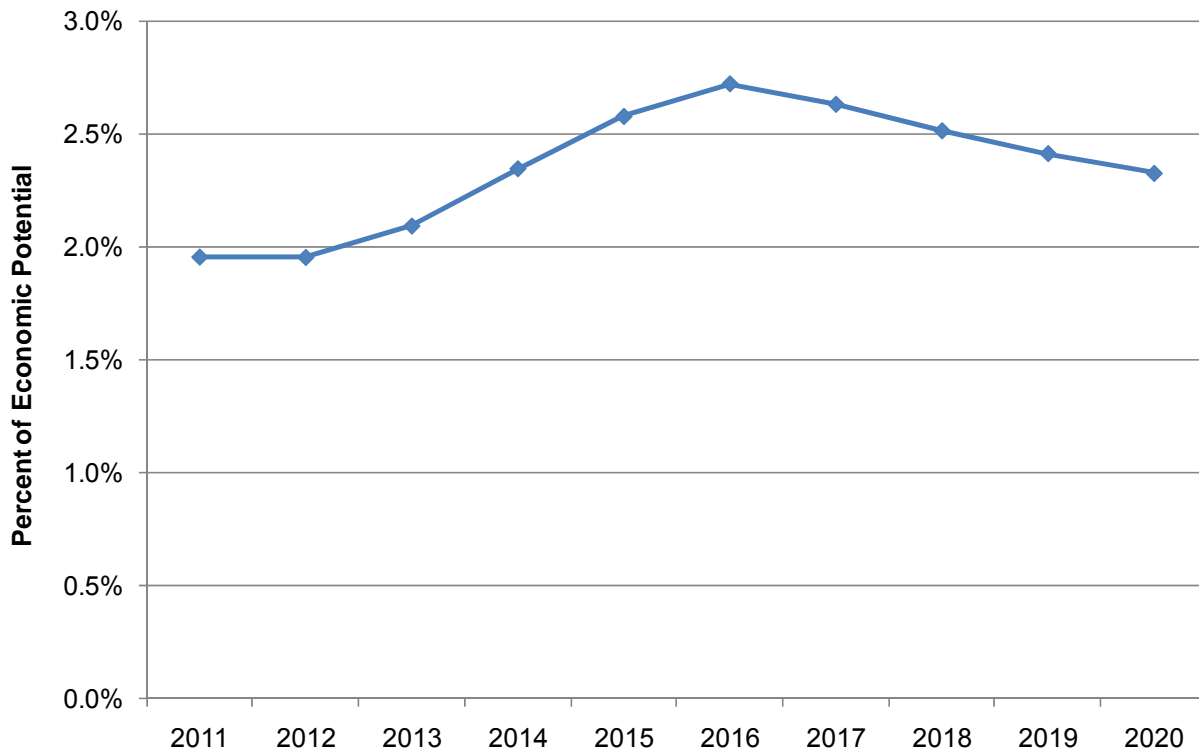


Source: Data obtained from California Energy Efficiency Resource Assessment Model (October 2010).

### Market Savings Potential and Targets

**Figure 130** shows Turlock's energy savings targets as a percentage of economic savings potential.

**Figure 130: Target Energy Savings as a Percentage of Economic Savings Potential—Turlock**

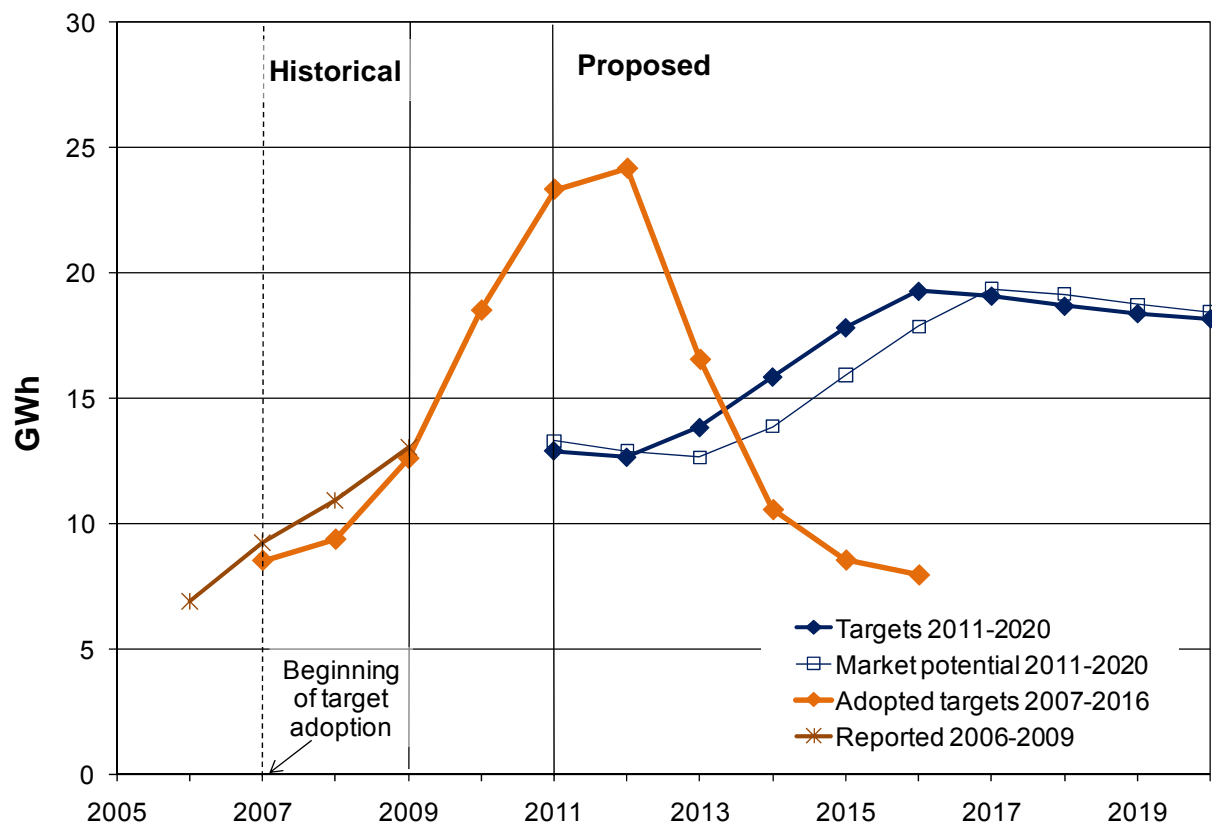


Source: Data obtained from California Municipal Utilities Association, *Energy Efficiency in California's Public Power Sector. A Status Report*, March 2010, combined with California Energy Efficiency Resource Assessment Models (October 2010).

**Figure 131** shows Turlock's new targets for 2011 to 2020 as compared with previous targets, past program savings, and recent estimates of market savings potential. Turlock's previous targets, set in 2007, followed an interesting path, increasing sharply through 2010, then declining again in 2012 through 2014. Turlock's new 2010 targets follow a more conventional path, increasing moderately from 2012 to 2016, then declining slowly through the end of the period. The revised 2011 to 2013 targets are roughly consistent with 2009 reported savings.

The ramp-up rate in Turlock's targets is moderately aggressive compared with the other utilities and show annualized growth of almost 11 percent between 2012 and 2016.

**Figure 131: Turlock's Historical Annual Energy Efficiency Program Savings and Targets**



Source: Data for 2011-2020 targets obtained from California Municipal Utilities Association, *Energy Efficiency in California's Public Power Sector. A Status Report*, March 2010. Data for 2011-2020 market potential obtained from California Energy Efficiency Resource Assessment Models (October 2010). Data for 2009 reported savings obtained from California Municipal Utilities Association, *Energy Efficiency in California's Public Power Sector. A Status Report*, March 2009. Data for 2007-2016 targets obtained from California Municipal Utilities Association, *Establishing Energy Efficiency Targets: A Public Power Response to AB2021. Final Update*, October 2007.

Turlock's 2011-2020 targets are higher than its market savings potential in some years but should be achievable since the utility's cumulative targets are close to its cumulative market savings potential.<sup>51</sup>

Developments in the nonresidential sector, primarily industrial, drive the decline in market savings potential after 2016. Awareness for most commercial measures reaches 100 percent by 2016 and most industrial measures by 2017; without increasing awareness, the decline in

51 For the March 2010 CMUA report, Turlock's targets were set the same as market savings potential. The October revision to the model produced market savings potentials that were different from those in the March report. (See Figure 4 and its accompanying discussion.)

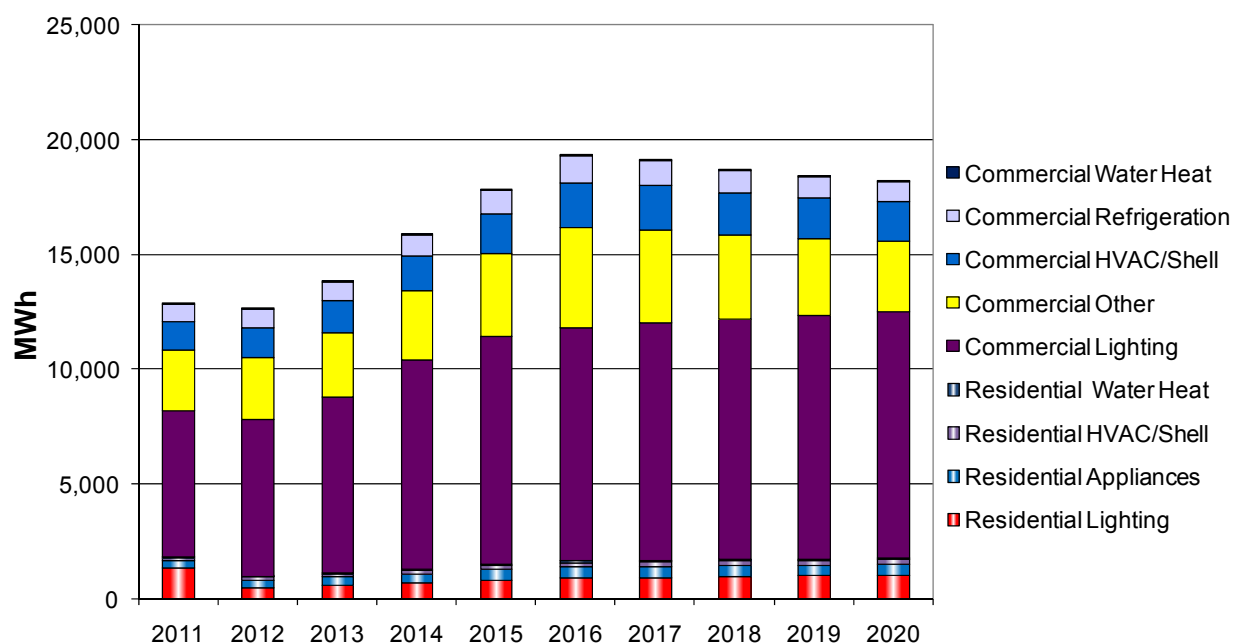
potential participants drives the savings. (The more customers adopt high-efficiency measures, the smaller the pool of potential participants.)

Turlock met its targets in 2007, 2008, and 2009. This success indicates that Turlock can probably meet its 2011 to 2013 targets with its current programs. Some additional effort may be required to reach targets in 2014 and beyond.

### Market Savings Potential by End Use

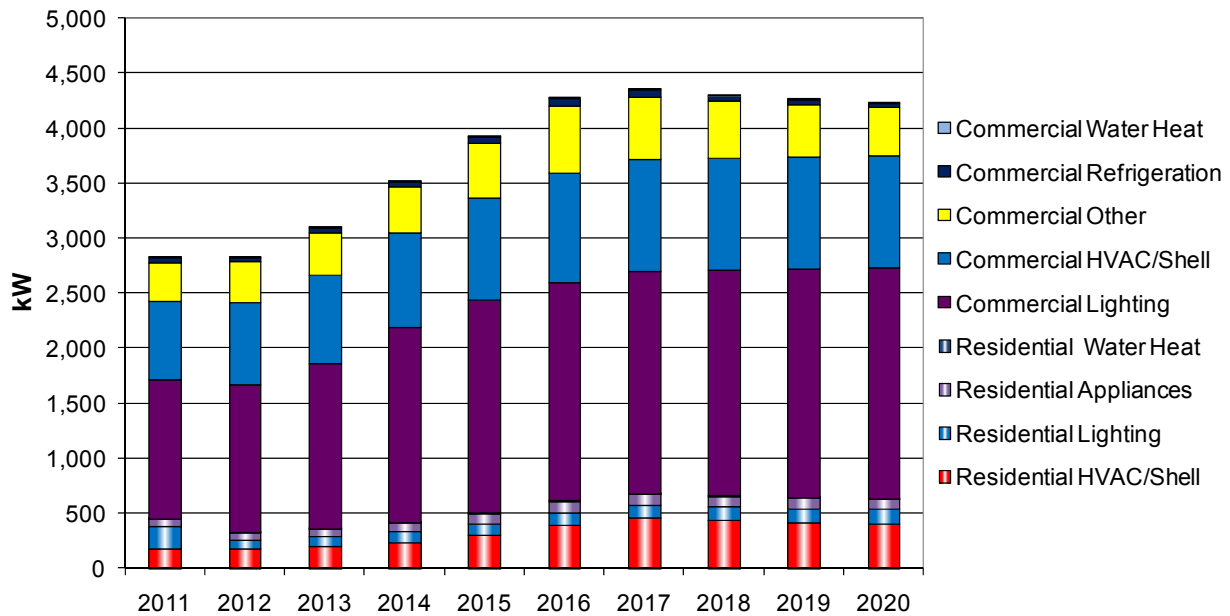
KEMA used revised 2010 CalEERAM data to break out market savings potential to show opportunities for specific programs by both customer sector and end use category. **Figure 132** and **Figure 133** show market energy and peak demand savings potential, respectively, by sector and end use. Commercial lighting is the largest contributor to market energy savings potential, followed by commercial “other.” Commercial lighting and commercial HVAC are the most significant contributors to market peak demand savings potential.

**Figure 132: Turlock’s Market Savings Potential (MWh) by End Use**



Source: Data obtained from California Energy Efficiency Resource Assessment Model (October 2010).

**Figure 133: Turlock's Market Savings Potential (kW) by End Use**



Source: Data obtained from California Energy Efficiency Resource Assessment Model (October 2010).

### Program Factors Affecting Target Feasibility and Reliability

Turlock's develops budgets in the late summer and adopts them in the fall. Turlock's board of directors meets weekly to consider new programs and changes to existing ones. Turlock continuously evaluates its programs against other utilities' findings, opinions, presentations, and EM&V results.

Turlock staff reports that the most frequent barrier to energy efficiency savings is a customer's willingness to invest in energy efficiency when the payback is not immediate. Just because a measure is ultimately cost-effective, it does not mean a customer will implement it.

In 2006, Turlock began meeting with its largest customers to offer to pay for financial grade energy audits at their facilities, initially identifying large savings. The customers that wanted to proceed then budgeted for the recommended energy efficiency upgrades. Utility staff indicates, however, that in the last couple of years it has been a struggle to get industrial customers to make similar commitments. Turlock is now focusing more attention on its smaller customers.

Turlock expects to use more third-party vendors in place of its staff in the future.

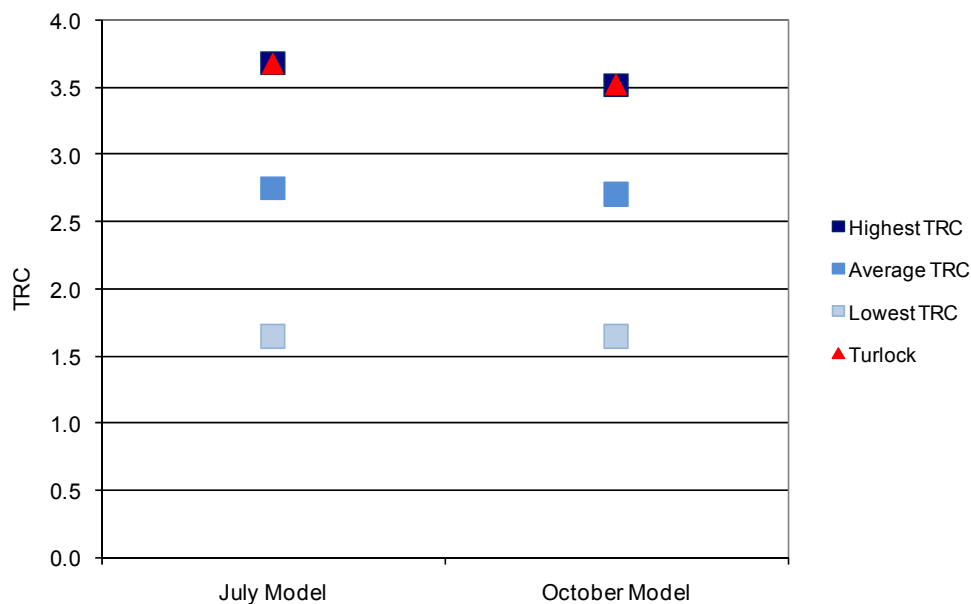
### Program Cost-Effectiveness

Turlock's fiscal year 2008/2009 programs had a TRC ratio of 3.61 (CMUA 2010, Table 7). The CalEERAM model used to set the targets shows a TRC ratio of 3.68. The error in the version of the model used to create this value increases uncertainty in the TRC ratio estimate, so reviewers also looked at the TRC ratio market savings potential from the revised CalEERAM, which is

3.52. **Figure 134** shows the two TRC ratios for Turlock as compared with the other utilities. Turlock's TRC ratio is the highest of the 12 utilities.

In 2015, the cost per-first-year kWh of savings from Turlock's model is 59 cents for residential and 31 cents for nonresidential in 2015, compared with an average of 58 cents for residential and 36 cents for nonresidential across all 12 POU models. Turlock's cost is close to average for residential and below average for nonresidential.

**Figure 134: Turlock's TRC Ratios From Two CalEERAM Versions, Compared to Other POUs**



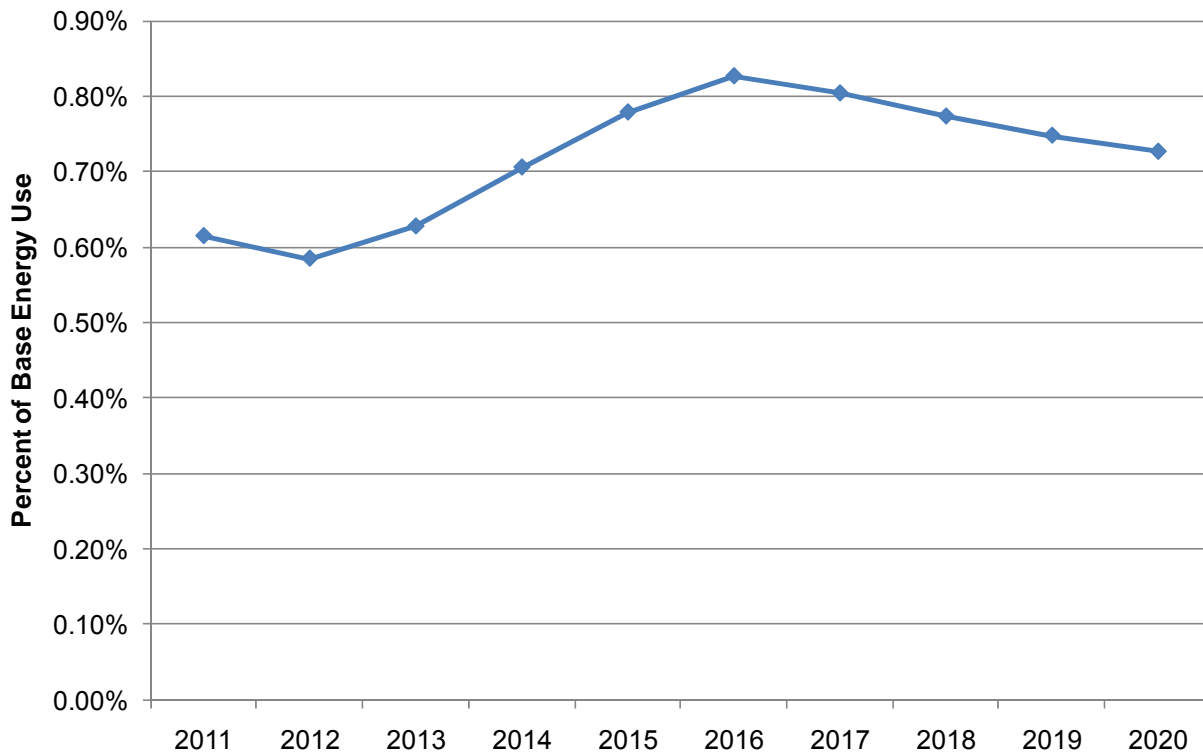
Source: Data obtained from California Energy Efficiency Resource Assessment Model (October 2010) and (July 2010) versions.

### Targets' Contribution to Energy Use Reduction

Successfully meeting its program targets will reduce Turlock's electricity use over the forecast period. **Figure 135** shows target energy savings as a percentage of total energy use.

Cumulatively, the targets add up to 8.4 percent of energy use forecasted for 2020 (based on the energy use forecast in the CalEERAM model), which does not meet the AB 2021 10 percent base energy use reduction requirement.

**Figure 135: Target Energy Savings as a Percentage of Base Energy Use—Turlock**



Source: Data obtained from California Municipal Utilities Association, *Energy Efficiency in California's Public Power Sector. A Status Report*, March 2010.

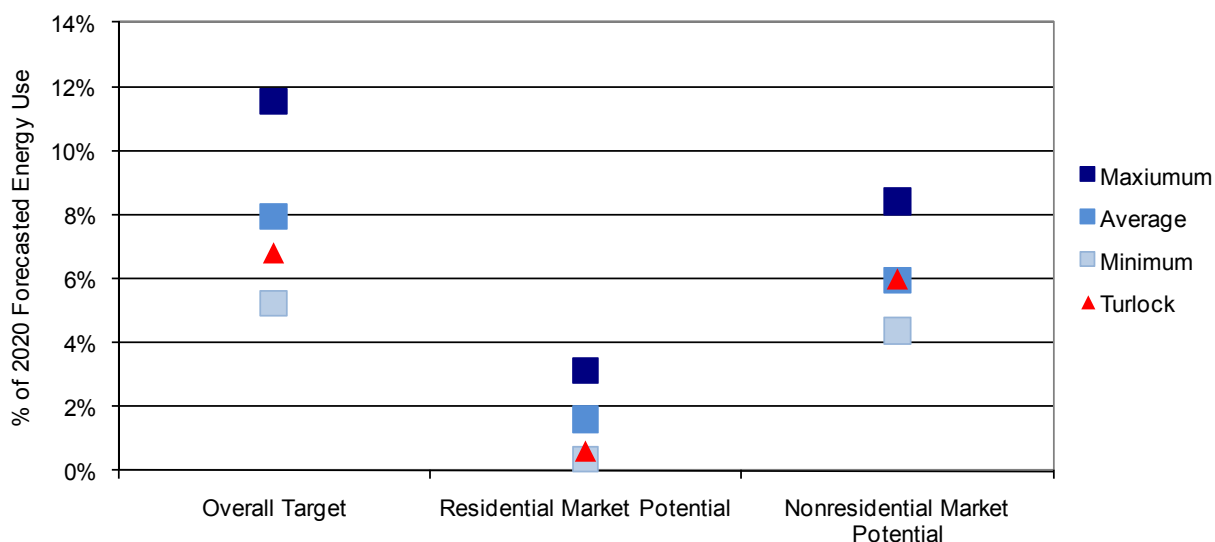
### Assessment of Targets

In this section, KEMA evaluates Turlock's targets by first comparing them with the other 11 POUs, then evaluating whether they adequately meet AB 2021 requirements (cost-effectiveness, feasibility, reliability, and energy use reduction).

**Figure 136** shows the sum of Turlock's 2011-2020 targets as a percentage of energy use, relative to those of other POUs. The overall target is from the March 2010 CMUA Report and represents Turlock's current commitments. Because the CMUA report did not break out targets by sector, **Figure 136** shows the sector breakdowns of market savings potentials from the October 2010 CalEERAM revision.

Turlock's target is below average for the 12 utilities in the detailed study. Turlock's residential market savings potential is near the minimum, and its nonresidential savings potential is close to average.

**Figure 136: Turlock's Targets, Compared With the Largest POUs**



Source: Data obtained from California Municipal Utilities Association, *Energy Efficiency in California's Public Power Sector. A Status Report*, March 2010, combined with California Energy Efficiency Resource Assessment Models (October 2010).

### Summary of Target Adequacy

In this section KEMA examines adopted targets across all four AB 2021 target assessment criteria. **Table 34** summarizes the findings. Turlock does not meet either the feasibility or the energy use reduction criteria. Turlock's targets are higher than estimated market savings potential for several years and cumulative through 2020.

**Table 34: Target Assessment—Turlock**

Target Criterion	Criteria Description	How Well Does It Meet This Criterion?
Cost-Effectiveness	TRC ratio $\geq 1$	TRC ratio = 3.52
Feasibility	<ul style="list-style-type: none"> <li>Revised targets are reasonably related to reported savings (2006-2009)?</li> <li>Revised targets are reasonably related to market savings potential?</li> <li>Annual ramp-up rate in future years is reasonable?</li> <li>Budget and staffing is likely to be in place to achieve targets?</li> </ul>	<p>Targets for 2011 to 2013 are in line with 2009 reported savings.</p> <p>Targets are higher than market savings potential for some years, and cumulative targets are slightly higher than cumulative market savings potential through 2020.</p> <p>Ramp-up 2012-2016 is moderately aggressive but achievable with appropriate budget and staffing.</p> <p>Additional budget and staffing will probably be required to meet targets in later years.</p>
Reliability	<ul style="list-style-type: none"> <li>Successfully achieved 2007 targets in most years?</li> <li>Utility performs regular EM&amp;V?</li> </ul>	<p>Turlock met its targets in 2007, 2008, and 2009.</p> <p>Turlock completed third party EM&amp;V impact studies of its 2008 and 2009 programs.</p>
Energy Use Reduction	<ul style="list-style-type: none"> <li>Meets 10% reduction over 10 years?</li> </ul>	Current targets reach 6.8% of base use over 10 years.

### Options for Increasing Efficiency

KEMA altered the inputs to Turlock's model to see what changes would be required for the market savings potential to meet the AB 2021 10-year energy use reduction requirement. KEMA applied the cost-effectiveness rule (TRC ratio  $\geq 1$ ) to all measures to determine whether they would be included in the analysis. KEMA then increased Turlock's incentive levels incrementally until market savings potential achieved 10 percent over 10 years. Setting incentives at 66 percent of incremental measure cost produced a 10 percent cumulative savings over 10 years with an overall TRC ratio of 3.37 and a 2011 cost of 56 cents per first-year kWh (decreasing to 52 cents per kWh by 2020). By comparison, Turlock's existing program has an overall TRC ratio of 3.61 and costs about 11 cents per kWh in fiscal year 2008/2009.<sup>52</sup>

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<sup>52</sup> Calculated from program data in CMUA (2010), Table 7.

## CHAPTER 6: Summary and Recommendations

This chapter summarizes key points from the assessment of the POU's 2010 CalEERAM used to estimate the three efficiency savings potential levels (technical, economic, and market) and of the efficiency targets adopted by the POUs. The 36 "CMUA group" POUs in the analysis submitted their data through the CMUA report *Energy Efficiency in California's Public Power Sector: A Status Report* in March 2010. The analysis of efficiency potential does not include LADWP or SMUD; these utilities will be completing their efficiency potential estimates later.

This chapter also presents recommendations for CalEERAM, for the documentation of savings potential estimates and targets, and for program planning to meet the 10-year goals of AB 2021.

### Efficiency Potential Model Assessment

The first time the POUs estimated efficiency potential as a group was in 2007.<sup>53</sup> Technical and economic savings potentials changed sharply between the 2007 and 2010 models, probably due to fundamentally different modeling approaches. The 2007 model used a top-down approach, which combined potential estimates from another study with information on POU energy use and number of customers. The 2010 model is a bottom-up model that builds up savings from assumptions about measure costs and savings, building stocks, equipment saturation, adoption patterns, codes and standards, and energy prices.

KEMA used a framework that assessed model approach, capabilities, structure, documentation, and consistency with other studies to evaluate the 2010 CalEERAM. KEMA then applied a second framework to evaluate the POU-specific models and inputs. The second framework examined the measure lists, measure inputs, avoided cost and rate inputs, customer disaggregation, and consistency with POU energy use forecasts, documentation, and model outputs.

KEMA found the CalEERAM approaches and algorithms sound. Model inputs came from reliable sources, and KEMA identified only a few possible issues.

While KEMA did identify some errors and issues in the model, the intent of this report is to review areas for improvement constructively. Key issues with the model include:

- POUs can calibrated market savings potentials based on past program experience (level of savings relative to program costs, for example). This calibration accounts for local market receptivity to program efforts. At least one POU, however, used the calibration to produce market savings potentials to meet the requirements of AB 2021 (10 percent savings over 10

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53, California Municipal Utility Association, *Establishing Energy Efficiency Targets: A Public Power Response to AB 2021, Final Update*, October 2007.

years) rather than calibrating to past program experience. In this case, the “market savings potential” is not a market savings potential at all and is not comparable to the market savings potential of utilities that calibrated to past program experience.

- POU can explicitly exclude energy efficiency measures from their economic savings potential analysis, even when they were cost-effective, which produced lower estimates of economic savings potential. This is not an appropriate approach for modeling economic savings potential. While there may be good reasons for excluding certain cost-effective measures from utility programs, such omissions should apply to market – not economic – potential.
- The treatment of residential air conditioning resulted in no cost-effective savings for most of the POUs. The lowest efficiency air-conditioning measure for existing homes, in most of the models, was a SEER 16+. The model should have assessed SEER 14 and SEER 15 units, and this assessment would have led to higher potentials.
- Quality control was an issue in several of the errors KEMA identified. These included the data error that led to model revisions in October 2011; incorrect rates for Pasadena; incorrect climate zones for some measures in some models; and incorrect floor space for Pasadena offices.
- The focus on the top three commercial building types by electricity use differed by utility, which made a comparison of results across all POUs difficult.
- The absence of a baseline analysis (energy balance or market characterization) made it difficult to identify errors like Pasadena’s office floor space issue.
- The use of an 80 percent net-to-gross ratio was optimistic in light of the 2006-2008 program evaluations performed for the investor-owned utilities.<sup>54</sup>

The final section recommends how the POUs can address these issues in their next round of target setting.

## Technical and Economic Efficiency Potential

Technical savings potential is by definition the complete penetration of efficiency measures where they are technically feasible. It is a theoretical concept because efficiency potential at the utility program level also depends on economic variables and practical market barriers.

The estimate of the CMUA group POUs’ combined technical efficiency potential is 10,693 GWh in 2020, which is 33 percent of their 2020 base energy use. The utilities’ technical savings potential ranges from 24 percent to 50 percent of 2020 energy use. At 24 percent, Silicon Valley Power was at the low end because of its low residential customer share. Four POUs had

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<sup>54</sup> California Public Utilities Commission (CPUC), *2006-2008 Energy Efficiency Evaluation Report*, July 2010; CPUC, *Energy Efficiency Evaluation Report for the 2009 Bridge Funding Period*, January 2011.

technical savings potential greater than 50 percent: Pasadena, Truckee, Lassen, and Plumas Sierra<sup>55</sup>.

The most recent technical savings potential estimate is 96 percent higher than the 2007 estimate of technical savings potential in 2016 for the same utilities. This marked increase is likely the result of a more comprehensive and detailed modeling approach, rather than an actual change in potential. This estimate of technical savings potential relative to base energy use is high compared with that for the California investor-owned utilities, which was 22 percent in the 2008 study estimate.<sup>56</sup> Technical savings potential for demand reductions is 2,861 MW in 2020, which is almost four times higher than the 2007 estimate for 2016.

Economic savings potential is the savings potential that a utility would achieve if it installed cost-effective measures in all feasible applications. The economic efficiency potential estimate for the CMUA group POU is 9,525 GWh through 2020, or 29 percent of base energy use. Two-thirds of the POU had economic savings potential that is greater than 80 percent of their technical savings potential in the 2010 study.

This estimate of economic savings potential is 136 percent higher than the 2007 study's estimate of economic savings potential in 2016 for the same utilities. It is also higher than the economic savings potential estimate for the investor-owned utilities, which was 19 percent of base energy use. The economic demand savings potential estimate is 2,283 MW in 2020, which is more than four times higher than the 2007 study estimate for 2016.

Some utilities explicitly excluded measures from their economic savings potential, even when they were cost-effective, which produced lower estimates of economic savings potential. This is not an appropriate approach for modeling economic savings potential. While there may be good reasons for excluding certain cost-effective measures from utility programs, such omissions should apply to market – not economic – potential.

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55 KEMA identified modeling issues for Pasadena and Truckee Donner that suggest potential estimates for those two utilities may be overstated. For example, Pasadena may have overstated office floor space, while Truckee may not in fact have the savings potential for the ground-source heat pumps suggested by the model. This would ultimately affect all three levels of efficiency potential.

56 Itron, 2008. *California Energy Efficiency Potential Study*. Prepared for PG&E on behalf of California investor-owned utilities. September 10, 2008.

## Market Efficiency Potential and Targets

The most significant efficiency potential for target setting and program planning is market savings potential, which is the assessment of program design, customer preferences, and market conditions. The market efficiency potential estimate is 2,205 GWh, which is 6.8 percent of base energy use in 2020. This is slightly higher than the 10-year market savings potential estimate for the same utilities in 2007. By comparison, the 10-year market savings potential estimate for the investor-owned utilities ranged from 3 percent to 6 percent of base energy use.

The cumulative market savings potential for publicly owned utilities is about 23 percent of the estimated economic savings potential over the 10-year period. By comparison, the 10-year market savings potential for the investor-owned utilities ranged from 15 percent to 33 percent of economic savings potential.<sup>57</sup>

The CMUA group POU's market savings potential, which represents about 0.7 percent of energy use per year, appears to reflect a moderate level of program effort in comparison with recent studies across the United States.<sup>58</sup> The estimate of market demand savings potential, which the Energy Commission uses as demand targets, is 526 MW in 2020, which is 74 percent higher than the 2007 study estimate for 2016.

Twenty-four of the 36 CMUA group POU's set targets equal to the market savings potentials published in the California Municipal Utilities Association's March 2010 report. The remaining 12 utilities (Alameda, Glendale, Gridley, Healdsburg, Lassen, Palo Alto, Pasadena, Port of Oakland, Shasta Lake, Trinity, Truckee, and Ukiah) set targets that differed from their respective March 2010 market savings potentials.<sup>59</sup>

While there is a great deal of individual variation, targets tend to be higher for the larger utilities and smaller for the smaller utilities. The 12 smallest POU's averaged a cumulative 2.9 percent over 10 years, with the targets for the 12 largest POU's averaging 7.6 percent. Mid-sized utilities had a mix of high and low targets and averaged 5.4 percent.

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57 For the 2008 IOU study, KEMA developed three primary market savings potential scenarios: a base scenario that mirrored 2004-2005 programs, a full incentive scenario that assumes incentives cover 100 percent of incremental measure costs, and a mid scenario with incentives set halfway between the base and full scenarios.

58 A comparison of recent potential studies and their scenarios shows that about half of the market savings potentials reflect annual savings between 0.4 percent and 1.0 percent of consumption, with the remainder showing annual savings greater than 1.0 percent of consumption. (See Appendix A.)

59 The overall cumulative target over the forecast period is 2.8 percent higher than cumulative market potential. The differences for some individual utilities were much larger; they ranged from a target 75 percent lower than market potential (Trinity) to a target that was more than double the market potential (Port of Oakland).

SMUD submitted revised savings targets to the Energy Commission in 2010. LADWP is in the process of updating its targets, so, at this writing its 2007 targets remain in effect. Because both SMUD and LADWP are much larger than other publicly owned utilities in the CMUA group, they have correspondingly higher targets. SMUD's target is comparable to the total targets for the largest 12 publicly owned utilities in the CMUA group. All these utilities together have a target of 607 GWh in 2011, with a cumulative target of 7,171 GWh from 2011 to 2020 (assuming LADWP's targets remain flat from 2016 through 2020).

Half of the utilities in the CMUA group set their 2011 targets less than their 2009 reported savings. Collectively, 2011 targets for the CMUA group added up to only 89 percent of 2009 reported savings.

KEMA evaluated POUs in the CMUA group for the AB 2021 target criteria: cost-effectiveness, feasibility, reliability, and projected energy use reduction. KEMA assumed target cost-effectiveness to be satisfied for all POUs because they applied the total resource cost (TRC) test to determine their economic efficiency potential. The relationship of the targets to recorded savings and market savings potential, the viability of the projected program ramp up rate, and the ability of expected budgets and staffing to support indicate target feasibility for the 12 largest POUs. The 12 largest POUs indicate target reliability by their success in meeting targets set for 2007 through 2009 and the use of third-party program evaluation to verify savings and improve programs. With some exceptions, the utilities passed target feasibility and reliability criteria.

KEMA evaluated all CMUA group POUs for the mandated AB 2021 criterion of 10 percent energy use reduction over 10 years. The combined POU target total does not meet that requirement, reaching savings of 6.8 percent of 2020 base energy use. Only 3 of the 36 utilities met the 10-year goal; two others fell slightly short of it, possibly due to rounding errors.

Most of the POUs developed market savings potential (hence, targets) assuming that the utility would provide customer incentives that equal 50 percent of the incremental cost of the installed efficiency measures. When KEMA used the utilities' models to run alternative 75 percent incentive scenarios, all but 1 of the 12 met the 10 percent market savings potential goal. This analysis indicates that the utilities could meet their AB 2021 goals but may require higher levels of program effort and budget than most of them factored into their targets.

## **Recommendations**

The following summarizes of recommendations related to the key findings listed above.

### **Enhance CalEERAM and Method for Next Round of Target Setting**

KEMA recommends that POUs use the existing CalEERAM for the next round of target setting. The model is basically sound, and, in the next modeling cycle, POUs can address the issues identified in this report. It is usually less expensive to update an existing model than to start

from scratch, and it is best to avoid radical changes in method. Furthermore, the POUs and the Energy Commission have both already devoted significant resources to understand and use the current model.

KEMA recommends the following revisions to the CalEERAM model:

- POUs should calculate market savings potential without regard to targets that they may have already set. POUs can, however, set targets differently from their market savings potential, as some did in 2010.
- The potential models should screen economic savings potential only for cost-effectiveness, without additional screening for market savings potential. Any such screen should occur at the market potential stage of the analysis.
- The model should include a consistent set of core commercial building types such as: office, retail, health, school, restaurant, grocery, lodging, and miscellaneous.
- For measures with multiple high-efficiency options (such as SEER 14, SEER 15, or SEER 16 for central air conditioners), the model should assess whether any of the efficiency levels pass the total resource cost (TRC) test, not just the highest-efficiency ones.
- The potential analysis should include a documented analysis of baseline energy use.
- The net-to-gross values used in the model should consider California investor owned utility evaluation results.

### Improve Documentation of Potential Estimates and Targets

To comply properly with the requirements of Assembly Bill 2021 and understand the assumptions behind the potential estimates and energy efficiency targets adopted by the utilities, the Energy Commission needs documentation that is more thorough. KEMA recommends that the following documentation be required:

- Utilities should provide the Energy Commission with the model version they used to calculate their targets.
- POUs and the consultant conducting the potential study should document the ways in which they customized the model and the reasons for the customization.

### More Proactive Program Planning to Meet the Goals of AB 2021

The analysis of publicly owned utility energy efficiency potentials and targets revealed that only 3 of the 36 publicly owned utilities are on track to achieve the 10-year Assembly Bill 2021 goals. In fact, the aggregated publicly owned utility targets are at 6.8 percent of forecasted 2020 base energy use, compared to the 10 percent statewide goal. Thus, publicly owned utilities should take more proactive steps to achieve the statewide energy efficiency goals:

- Implement more aggressive ramp up of energy efficiency targets and programmatic initiatives, particularly among the smaller publicly owned utilities

- Develop a detailed plan to achieve 10 percent savings goal
- Consider higher incentive levels and expanded portfolio of energy efficiency programs
- Partner with other POU's or with the California IOUs to implement energy efficiency programs, in order to capture economies of scale.

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**Attachment A: Assembly Bill 2021 (Levine, Chapter 734, Statutes of 2006)**

## Assembly Bill No. 2021

### CHAPTER 734

An act to add Section 25310 to the Public Resources Code, and to amend Section 9615 of the Public Utilities Code, relating to energy efficiency.

[Approved by Governor September 29, 2006. Filed with  
Secretary of State September 29, 2006.]

#### LEGISLATIVE COUNSEL'S DIGEST

AB 2021, Levine. Public utilities: energy efficiency.

(1) The Warren-Alquist State Energy Resources Conservation and Development Act establishes the State Energy Resources Conservation and Development Commission (Energy Commission) and requires it to prepare an integrated energy policy report on or before November 1, 2003, and every 2 years thereafter. Under that act, the Energy Commission also administers existing law with respect to energy conservation.

Existing law authorizes the Public Utilities Commission to regulate public utilities, including electrical and gas corporations. The Public Utilities Act requires the commission to review and adopt a procurement plan for each electrical corporation. Under existing law, the commission, in consultation with the Energy Commission, is required to identify all potentially achievable cost-effective electricity efficiency savings and to establish efficiency targets for an electrical corporation to achieve pursuant to its procurement plan. Existing law requires that an electrical corporation's procurement plan include a showing that the electrical corporation will first meet its unmet resource needs through all available energy efficiency and demand reduction resources that are cost effective, reliable, and feasible. Existing law requires the commission, in consultation with the Energy Commission, to identify all potentially achievable cost-effective natural gas efficiency savings and to establish efficiency targets for the gas corporation to achieve these targets and to require that a gas corporation first meet its unmet gas resource needs through all available natural gas efficiency and demand reduction resources that are cost effective, reliable, and feasible.

This bill would require the Energy Commission, on or before November 1, 2007, and every 3 years thereafter, in consultation with the commission and local publicly owned electric utilities, in a public process that allows input from other stakeholders, to develop a statewide estimate of all potentially achievable cost-effective electricity and natural gas efficiency savings and establish statewide annual targets for energy efficiency savings and demand reduction over 10 years. The bill would require the commission to base its estimate at least in part on the most recent targets

established by the commission and local publicly owned electric utilities. The bill would require the Energy Commission to include in the integrated energy policy report, for each electrical corporation and each gas corporation, a comparison of the public utility's annual energy efficiency targets, and the public utility's actual energy efficiency savings and demand reductions.

(2) The bill would require the Energy Commission to investigate options and develop a plan to improve the energy efficiency of, and to decrease the peak electricity demand of, air-conditioners in the state. The bill would require the Energy Commission, on or before January 1, 2008, to prepare and submit to the Legislature a report on that plan.

(3) Existing law requires each local publicly owned electric utility, in procuring energy, to first acquire all available energy efficiency and demand reduction resources that are cost effective, reliable, and feasible. Existing law requires each local publicly owned electric utility to report annually to its customers and to the Energy Commission, its investment in energy efficiency and demand reduction programs, as specified.

This bill would require a local publicly owned electric utility, on or before June 1, 2007, and every 3 years thereafter, to identify all potentially achievable cost-effective electricity efficiency savings and to establish annual targets for energy efficiency savings and demand reduction over 10 years. The bill would require a local publicly owned electric utility to report those targets to the Energy Commission within 60 days of the date of adoption. The bill would require an annual report by a local publicly owned electric utility to its customers and the Energy Commission on its investments, programs, expenditures, cost-effectiveness, and results, as prescribed. The bill would also require an annual report to the Energy Commission on investment funding, cost-effectiveness methodologies, and an independent evaluation. The bill would require the Energy Commission to include a summary of the information reported by local publicly owned electric utilities and a comparison of each utility's energy efficiency targets and actual results in the integrated energy policy report. The bill would require the Energy Commission, if it determines that improvements can be made in setting or meeting annual targets, to provide recommendations to the local publicly owned electric utility, the Legislature, and the Governor on those improvements. The bill, by establishing new requirements for local publicly owned electric utilities, would create a state-mandated local program.

The California Constitution requires the state to reimburse local agencies and school districts for certain costs mandated by the state. Statutory provisions establish procedures for making that reimbursement.

This bill would provide that no reimbursement is required by this act for a specified reason.

*The people of the State of California do enact as follows:*

SECTION 1. (a) In order to ensure that prudent investments in energy efficiency continue to be made that produce cost-effective energy savings, reduce customer demand, reduce overall system costs, increase reliability, and increase public health and environmental benefits, it is the intent of the Legislature that all load-serving entities procure all cost-effective energy efficiency measures so that the state can meet the goal of reducing total forecasted electrical consumption by 10 percent over the next 10 years.

(b) Expanding California's energy efficiency programs will promote lower energy bills, protect public health, improve environmental quality, stimulate sustainable economic development, create new employment opportunities, and reduce reliance on imported fuels.

(c) Expanding California's energy efficiency programs will ameliorate air quality problems throughout the state and will also reduce harmful greenhouse gas emissions.

(d) The energy savings achieved through the enactment of this act are an essential component of the state's plan to meet the Governor's greenhouse gas reduction targets established in Executive Order S-3-05.

SEC. 2. Section 25310 is added to the Public Resources Code, to read:

25310. On or before November 1, 2007, and by November 1 of every third year thereafter, the commission in consultation with the Public Utilities Commission and local publicly owned electric utilities, in a public process that allows input from other stakeholders, shall, develop a statewide estimate of all potentially achievable cost-effective electricity and natural gas efficiency savings and establish targets for statewide annual energy efficiency savings and demand reduction for the next 10-year period. The commission shall base its estimate at least in part on information developed pursuant to Sections 454.55, 454.56, and 9615 of the Public Utilities Code. The commission shall, for each electrical corporation and each gas corporation, include in the integrated energy policy report, a comparison of the public utility's annual targets established pursuant to Sections 454.55 and 454.56, and the public utility's actual energy efficiency savings and demand reductions.

SEC. 3. Section 9615 of the Public Utilities Code is amended to read:

9615. (a) Each local publicly owned electric utility, in procuring energy to serve the load of its retail end-use customers, shall first acquire all available energy efficiency and demand reduction resources that are cost effective, reliable, and feasible.

(b) On or before June 1, 2007, and by June 1 of every third year thereafter, each local publicly owned electric utility shall identify all potentially achievable cost-effective electricity efficiency savings and shall establish annual targets for energy efficiency savings and demand reduction for the next 10-year period. A local publicly owned electric utility's determination of potentially achievable cost-effective electricity efficiency savings shall be made without regard to previous minimum investments undertaken pursuant to Section 385. A local publicly owned

electric utility shall treat investments made to achieve energy efficiency savings and demand reduction targets as procurement investments.

(c) Within 60 days of adopting annual targets pursuant to subdivision (b), each local publicly owned electric utility shall report those targets to the State Energy Resources Conservation and Development Commission, and the basis for establishing those targets.

(d) Each local publicly owned electric utility shall report annually to its customers and to the State Energy Resources Conservation and Development Commission. The report shall contain, but is not limited to, both of the following:

(1) Its investments in energy efficiency and demand reduction programs.

(2) A description of programs, expenditures, cost-effectiveness, and expected and actual energy efficiency savings and demand reduction results.

(e) Each local publicly owned electric utility shall also annually develop and submit to the State Energy Resources Conservation and Development Commission a report containing all of the following:

(1) The sources of funding for its investments in energy efficiency and demand reduction program investments.

(2) The methodologies and input assumptions used to determine cost-effectiveness.

(3) The results of an independent evaluation that measures and verifies the energy efficiency savings and reduction in energy demand achieved by its energy efficiency and demand reduction programs.

(f) The State Energy Resources Conservation and Development Commission shall include a summary of the information reported pursuant to subdivision (e) in the integrated energy policy report prepared pursuant to Chapter 4 (commencing with Section 25300) of Division 15 of the Public Resources Code. The State Energy Resources Conservation and Development Commission shall also include, for each local publicly owned electric utility, a comparison of the local publicly owned electric utility's annual targets established in accordance with this section, and the local publicly owned electric utility's actual energy efficiency savings and demand reductions. If the State Energy Resources Conservation and Development Commission determines that improvements can be made in either the level of a local publicly owned electric utility's annual targets to achieve all cost-effective, reliable, and feasible energy savings and demand reductions and to enable the local publicly owned electric utilities, in the aggregate, to achieve statewide targets established pursuant to Section 25310, or in meeting each local publicly owned electric utility's annual targets, the State Energy Resources Conservation and Development Commission shall provide recommendations to the local publicly owned electric utility, the Legislature, and the Governor on those improvements.

SEC. 4. (a) The Legislature finds and declares that the use of air-conditioners in a hot, dry climate drives peak electricity demand in much of this state.

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(b) The State Energy Resources Conservation and Development Commission shall do both of the following:

(1) Investigate options and develop a plan to improve the energy efficiency of, and to decrease the peak electricity demand of, air-conditioners.

(2) On or before January 1, 2008, prepare and submit to the Legislature a report on the plan developed pursuant to subdivision (a), including, but not limited to, any changes in law the State Energy Resources Conservation and Development Commission recommends to implement the plan.

SEC. 5. No reimbursement is required by this act pursuant to Section 6 of Article XIII B of the California Constitution because a local agency or school district has the authority to levy service charges, fees, or assessments sufficient to pay for the program or level of service mandated by this act, within the meaning of Section 17556 of the Government Code.

# APPENDIX A: Results of Recent Potential Studies in the United States and Canada

Table A-1 shows estimated achievable savings potential as a percentage of base load from several recent studies in the United States and Canada.

**Table A-1: Achievable Potential Estimates as a Percentage of Base Load – Recent Studies in the United States and Canada**

Area	Study Year	Number of Years	Scenario	Achievable Savings as a percent of Base Load	% Savings / Years	Source
AmerenUE, MO	2010	12	Realistic Achievable	6.5%	0.5%	AmerenUE Demand Side Management (DSM) Market Potential Study Volume 1: Executive Summary, Global Energy Partners, January 2010
AmerenUE, MO	2010	12	Maximum Achievable	9.8%	0.8%	AmerenUE Demand Side Management (DSM) Market Potential Study Volume 1: Executive Summary, Global Energy Partners, January 2010
AmerenUE, MO	2010	12	Business as Usual	5.4%	0.5%	AmerenUE Demand Side Management (DSM) Market Potential Study Volume 1: Executive Summary, Global Energy Partners, January 2010
Missouri	2011	10	3-Year Payback	3.8%	0.4%	Missouri Statewide DSM Market Potential Study - DRAFT, KEMA, Inc. January 15, 2011
Missouri	2011	10	1-Year Payback	6.8%	0.7%	Missouri Statewide DSM Market Potential Study - DRAFT, KEMA, Inc. January 15, 2011
Missouri	2011	10	75% Incentives	9.5%	1.0%	Missouri Statewide DSM Market Potential Study - DRAFT, KEMA, Inc. January 15, 2011
Wisconsin	2009	11			1.6%	A Review and Analysis of Existing Studies of the Energy Efficiency Resource Potential in the Midwest, Energy Center of Wisconsin and ACEEE, August 2009, includes annotated bibliography
Kansas	2008	21			1.1%	A Review and Analysis of Existing Studies of the Energy Efficiency Resource Potential in the Midwest, Energy Center of Wisconsin and ACEEE, August 2009, includes annotated bibliography
Florida	2007	15			1.3%	A Review and Analysis of Existing Studies of the Energy Efficiency Resource Potential in the Midwest, Energy Center of Wisconsin and ACEEE, August 2009, includes annotated bibliography
Texas	2007	15			1.2%	A Review and Analysis of Existing Studies of the Energy Efficiency Resource Potential in the Midwest, Energy Center of Wisconsin and ACEEE, August 2009, includes annotated bibliography
Utah	2007	15			1.7%	A Review and Analysis of Existing Studies of the Energy Efficiency Resource Potential in the Midwest, Energy Center of Wisconsin and ACEEE, August 2009, includes annotated bibliography

**Table A-1: Achievable Potential Estimates as a Percentage of Base Load – Recent Studies in the United States and Canada**

Area	Study Year	Number of Years	Scenario	Achievable Savings as a percent of Base Load	% Savings / Years	Source
Vermont	2007	10			1.9%	A Review and Analysis of Existing Studies of the Energy Efficiency Resource Potential in the Midwest, Energy Center of Wisconsin and ACEEE, August 2009, includes annotated bibliography
California	2006	13			0.6%	A Review and Analysis of Existing Studies of the Energy Efficiency Resource Potential in the Midwest, Energy Center of Wisconsin and ACEEE, August 2009, includes annotated bibliography
North Carolina	2006	10			1.4%	A Review and Analysis of Existing Studies of the Energy Efficiency Resource Potential in the Midwest, Energy Center of Wisconsin and ACEEE, August 2009, includes annotated bibliography
Georgia	2005	10			0.9%	A Review and Analysis of Existing Studies of the Energy Efficiency Resource Potential in the Midwest, Energy Center of Wisconsin and ACEEE, August 2009, includes annotated bibliography
New England	2005	10			2.3%	A Review and Analysis of Existing Studies of the Energy Efficiency Resource Potential in the Midwest, Energy Center of Wisconsin and ACEEE, August 2009, includes annotated bibliography
Northwest	2005	20			0.6%	A Review and Analysis of Existing Studies of the Energy Efficiency Resource Potential in the Midwest, Energy Center of Wisconsin and ACEEE, August 2009, includes annotated bibliography
Ontario	2005	20			0.7%	A Review and Analysis of Existing Studies of the Energy Efficiency Resource Potential in the Midwest, Energy Center of Wisconsin and ACEEE, August 2009, includes annotated bibliography
Wisconsin	2005	10			0.8%	A Review and Analysis of Existing Studies of the Energy Efficiency Resource Potential in the Midwest, Energy Center of Wisconsin and ACEEE, August 2009, includes annotated bibliography
New Jersey	2004	16			7.0%	A Review and Analysis of Existing Studies of the Energy Efficiency Resource Potential in the Midwest, Energy Center of Wisconsin and ACEEE, August 2009, includes annotated bibliography
Quebec	2004	8			4.0%	A Review and Analysis of Existing Studies of the Energy Efficiency Resource Potential in the Midwest, Energy Center of Wisconsin and ACEEE, August 2009, includes annotated bibliography
U.S.	2001	20			1.2%	A Review and Analysis of Existing Studies of the Energy Efficiency Resource Potential in the Midwest, Energy Center of Wisconsin and ACEEE, August 2009, includes annotated bibliography
US (EPRI)	2009	12	Realistic Achievable	4.3%	0.4%	Assessment of Achievable Potential from Energy Efficiency and Demand Response Programs in the U.S., EPRI with Global Energy Partners and The Brattle Group, January 2009
US (EPRI)	2009	12	Maximum Achievable	10.1%	0.8%	Assessment of Achievable Potential from Energy Efficiency and Demand Response Programs in the U.S., EPRI with Global Energy Partners and The Brattle Group, January 2009
Northwest	2007	20		9.2%	0.5%	Assessment of Long-Term, System-Wide Potential for Demand-Side and Other Supplemental Resources, Quantec with Summit Blue and Nexant, July 11, 2007
British Columbia	2007	10	Upper	11.7%	1.2%	BC Hydro 2007 Conservation Potential Review: the Potential for Electricity Savings, 2006-2016, Marbek Resource Consultants, Ltd., November 20, 2007
British Columbia	2007	10	Lower	6.0%	0.6%	BC Hydro 2007 Conservation Potential Review: the Potential for Electricity Savings, 2006-2016, Marbek Resource Consultants, Ltd., November 20, 2007
Xcel	2010	11	100%	14.9%	1.4%	Colorado DSM Market Potential Assessment, KEMA, March 12, 2010

**Table A-1: Achievable Potential Estimates as a Percentage of Base Load – Recent Studies in the United States and Canada**

Area	Study Year	Number of Years	Scenario	Achievable Savings as a percent of Base Load	% Savings / Years	Source
Energy, CO			Incentives			
Xcel Energy, CO	2010	11	75% Incentives	8.6%	0.8%	Colorado DSM Market Potential Assessment, KEMA, March 12, 2010
Xcel Energy, CO	2010	11	50% Incentives	5.5%	0.5%	Colorado DSM Market Potential Assessment, KEMA, March 12, 2010
Iowa	2009	9	Moderate	11.0%	1.2%	Energy Efficiency and Demand Response Potential for Iowa Municipal Utilities, Energy Center of Wisconsin, June 2009
ConEd - New York	2010	9	Maximum Achievable	15.0%	1.7%	Energy Efficiency Potential Study for Consolidated Edison Company of New York, Inc. Volume 1: Executive Summary; Global Energy Partners, June 2010
ConEd - New York	2010	9	Realistic Achievable - High	10.0%	1.1%	Energy Efficiency Potential Study for Consolidated Edison Company of New York, Inc. Volume 1: Executive Summary; Global Energy Partners, June 2010
ConEd - New York	2010	9	Realistic Achievable - Mid	9.0%	1.0%	Energy Efficiency Potential Study for Consolidated Edison Company of New York, Inc. Volume 1: Executive Summary; Global Energy Partners, June 2010
ConEd - New York	2010	9	Realistic Achievable - Low	8.0%	0.9%	Energy Efficiency Potential Study for Consolidated Edison Company of New York, Inc. Volume 1: Executive Summary; Global Energy Partners, June 2010
Minnesota	2010	20	Base	12.3%	0.6%	Minnesota Statewide Electricity Efficiency Potential Study DSM Potentials Report, Summit Blue Consulting, April 30, 2010
Minnesota	2010	20	High	13.9%	0.7%	Minnesota Statewide Electricity Efficiency Potential Study DSM Potentials Report, Summit Blue Consulting, April 30, 2010
Minnesota	2010	20	Low	11.7%	0.6%	Minnesota Statewide Electricity Efficiency Potential Study DSM Potentials Report, Summit Blue Consulting, April 30, 2010
California	2003	10	Most aggressive scenario	10.0%	1.0%	Nadel, Steve, Shipley, A., and Elliott, R. N., Technical, Economic, and Achievable Potential for Energy-Efficiency in the U.S. - A Meta-Analysis of Recent Studies, 2004 ACEEE Summer Study, Includes references to specific studies
Puget Power	2003	20	Most aggressive scenario	11.0%	0.6%	Nadel, Steve, Shipley, A., and Elliott, R. N., Technical, Economic, and Achievable Potential for Energy-Efficiency in the U.S. - A Meta-Analysis of Recent Studies, 2004 ACEEE Summer Study, Includes references to specific studies
U.S.	2003	20	Most aggressive scenario	24.0%	1.2%	Nadel, Steve, Shipley, A., and Elliott, R. N., Technical, Economic, and Achievable Potential for Energy-Efficiency in the U.S. - A Meta-Analysis of Recent Studies, 2004 ACEEE Summer Study, Includes references to specific studies
Vermont	2003	10	Most	31.0%	3.1%	Nadel, Steve, Shipley, A., and Elliott, R. N., Technical, Economic, and Achievable Potential for

**Table A-1: Achievable Potential Estimates as a Percentage of Base Load – Recent Studies in the United States and Canada**

Area	Study Year	Number of Years	Scenario	Achievable Savings as a percent of Base Load	% Savings / Years	Source
			aggressive scenario			Energy-Efficiency in the U.S. - A Meta-Analysis of Recent Studies, 2004 ACEEE Summer Study, Includes references to specific studies
Southwest	2002	17	Most aggressive scenario	33.0%	1.9%	Nadel, Steve, Shipley, A., and Elliott, R. N., Technical, Economic, and Achievable Potential for Energy-Efficiency in the U.S. - A Meta-Analysis of Recent Studies, 2004 ACEEE Summer Study, Includes references to specific studies
Connecticut	2009	10	Base	10.0%	1.0%	Potential for Energy Efficiency in Connecticut, KEMA, May 1, 2009
Connecticut	2009	10	Current	11.0%	1.1%	Potential for Energy Efficiency in Connecticut, KEMA, May 1, 2009
Connecticut	2009	10	Accelerated	20.0%	2.0%	Potential for Energy Efficiency in Connecticut, KEMA, May 1, 2009
New Mexico	2006	10	Base	3.4%	0.3%	Public Service New Mexico Electric Energy Efficiency Potential Study, Itron, Inc. with assistance from KEMA, Inc., September 20, 2006
New Mexico	2006	10	Advanced	6.1%	0.6%	Public Service New Mexico Electric Energy Efficiency Potential Study, Itron, Inc. with assistance from KEMA, Inc., September 20, 2006
New Mexico	2006	10	Maximum Achievable	8.2%	0.8%	Public Service New Mexico Electric Energy Efficiency Potential Study, Itron, Inc. with assistance from KEMA, Inc., September 20, 2006

# APPENDIX B: Evaluation Frameworks

## Framework 1: Framework for Evaluating Energy Efficiency Potential Model Structure and Design

The framework presented here provides a consistent, systematic approach to assess the models used by the California publicly owned utilities (POUs) to estimate energy efficiency savings potential.

Energy efficiency potential studies provide data needed to support energy efficiency policies and programs, including the following activities:

- Setting attainable energy savings targets
- Quantifying the energy efficiency resource for system planning
- Determining funding levels for delivering energy-efficiency programs
- Designing programs to achieve the long-term potential
- Reassessing energy efficiency opportunities as conditions change

The objective of this review is to ensure that POU efficiency potentials, and therefore efficiency targets, are based on comprehensive and well-designed models; that these models are well-documented and consistent with models used by the California investor-owned utilities (IOU). The framework was developed based on the National Action Plan for Energy Efficiency's Guide for Conducting Energy Efficiency Potential Studies and KEMA's extensive experience with efficiency potential studies.

The purpose of this framework is to assess the models used to create the potential estimates for the POUs, not to critique the estimates themselves. That is, we will only look at the models' capabilities and structures, and not at the measures that were included, nor the measure cost and savings inputs, nor other inputs that will vary between utilities. We will develop a separate framework that will be applied at the POU level and address how the model was implemented and what inputs were used.

This framework is accompanied by an Microsoft Excel based scoring template <Framework for Potential Models – Form.xls>, with a notes (description) field associated with each scoring criterion.

### 1. Reporting/Documentation Adequacy

Potential models are complex. Depending on the model's structure (e.g. a software program vs. a spreadsheet-based calculation) the steps of the analysis may be fairly easy to track or extremely difficult. Model documentation should provide the conceptual framework for the potential calculation, identify the types of inputs required by the model, and provide key

equations for the calculation of savings potential. The documentation should provide enough information to interpret the input and output files or worksheets.

Criterion 1.1. Is there documentation of the model logic and structure that is sufficient to support a effective review of the model?

- 1 – No. There is no documentation at all.
- 2 – No. The documentation is inadequate to aid in a review of the model.
- 3 – Partial. The documentation is adequate to support only a partial review of the model.
- 4 – Partial. The written documentation is inadequate, but the model is in a format that allows a knowledgeable reviewer to track the calculations and logic (e.g. a spreadsheet).
- 5 – Yes. The documentation is adequate to support a complete review of the model.

## 2. General Method

### 2.1 Model Structure

Comprehensive potential studies generally build up savings from assumptions about measure costs and savings, building stocks, nonmarket barriers, consumer preferences, codes and standards, and energy prices (bottom-up studies). Studies with less budget may develop baseline usage (by sector, building type, etc.), and apply the potential saving estimates from another, more comprehensive, study from another utility or region (top-down studies).

Criterion 2.1. How does the model structure develop savings potential?

- 1 – Built off other modeling results.
- 2 – Built up from measure-level inputs.
- 3 – Other. Include brief description \_\_\_\_\_

### 2.2 General Savings Potential Methodology

The calculation of savings potential can usually be summarized in a simple formula (the complexity of potential models is in the execution, not the concept). For example, KEMA's DSM ASSYST model has the following formula at the heart of its calculations:

$$\begin{array}{ccccccc} \text{Technical} & & \text{Total} & & \text{Base} & & \text{Not} \\ \text{Potential of} & = & \text{Square} & \times & \text{Case} & \times & \text{Complete} & \times & \text{Feasibility} & \times & \text{Savings} \\ \text{Efficient} & & \text{Feet} & & \text{Equipment} & & \text{Factor} & & \text{Factor} & & \text{Factor} \\ \text{Measure} & & & & \text{kWh/sq ft} & & & & & & \end{array}$$

Such a formula is typical of a bottom-up approach, although the specific structure will vary. A top-down approach would differ, but should incorporate some way to allocate or pro-rate high-level savings estimates to measures and building types. The following question addresses whether the underlying formulas and conceptual underpinnings of the potential calculations can be expected to produce the desired potentials.

Criterion 2.2. Is the savings potential developed in a reasonable way?

- 1 – No. The development of savings potential has flaws that would significantly impact all potential estimates.
- 2 – Partially. The development of savings potential has flaws that would significantly impact some of the potential estimate (e.g. affects certain sectors, or affects program achievable but not technical or economic potential).
- 3 – Partially. The development of savings potential has flaws, but they are minor and do not appear to have a significant impact on potential estimates.
- 4 – Yes. The savings potentials are developed in a reasonable way.

### 2.3 Model Flexibility and Robustness

Different utilities may choose to use different assumptions about discount rates, inflation rates, forecast time frame, etc., which could pose a barrier to aggregating results across utilities. Aggregation of multiple utility energy efficiency potentials may require that some of these inputs be altered. If the model is flexible enough to make such changes easily, aggregation will be relatively easy. If assumptions are difficult to change, for example because they are embedded in formulas, then aggregation could be very difficult.

Criterion 2.3. Is the model robust enough to address changes in assumptions that might be required to allow for aggregation of results?

- 1 – No.
- 2 – Partially.
- 3 – Yes.

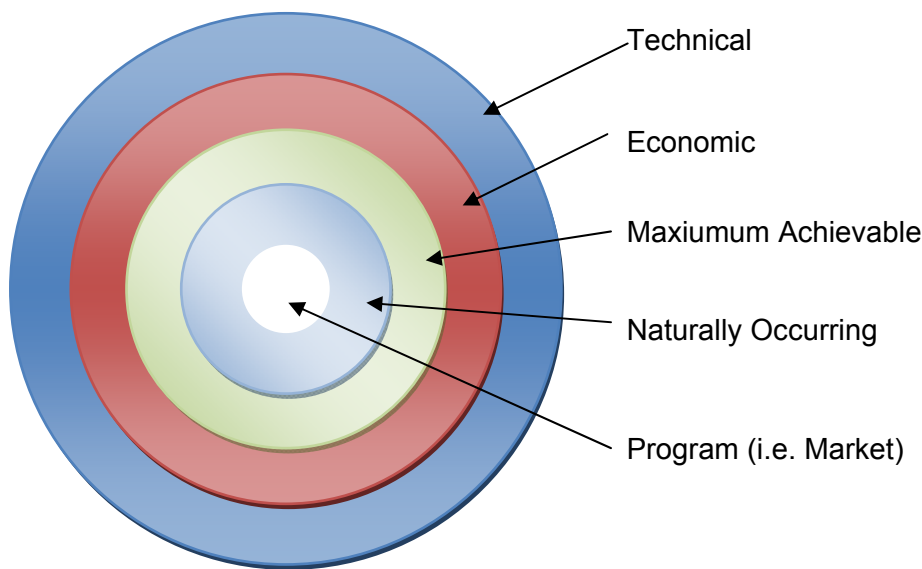
### 3. Model Capabilities

Potential studies may calculate a number of different types of energy-efficiency potential: technical, economic, maximum achievable, program achievable (budget constrained), and naturally occurring. These potentials are shown conceptually in the following figure and described below.

- Technical potential is defined as the complete penetration of all measures analyzed in applications where they were deemed technically feasible from an engineering perspective. It is not associated with a time frame, and calculated as if all possible measures could be installed instantaneously.
- Economic potential refers to the technical potential of only the energy-efficiency measures that are cost effective when compared to supply-side alternatives, based on a selected cost-effectiveness metric (see Criterion 4.1). Like technical potential, it is instantaneous and not associated with a particular time frame.

- Maximum achievable potential is the amount of savings that can be achieved through energy-efficiency programs assuming the most adept program design and execution experienced by similar energy-efficiency programs. Unlike technical and economic potential, it is associated with a specific time frame. It is therefore limited by the rate at which replace-on-burnout measures turn over (equipment failure), and the rate at which new buildings are constructed, as well as market barriers and patterns of technology adoption. The maximum achievable potential scenario takes into account that some of the technical and economical potential may be achieved through other avenues, such as building codes and appliance standards.
- Program potential refers to the amount of savings that would occur in response to specific program funding and measure incentive levels, over a specified time frame. Savings associated with program potential are savings that are projected beyond those that would occur naturally in the absence of any market intervention.
- Naturally occurring potential refers to the amount of savings estimated to occur as a result of normal market forces; that is, in the absence of any utility or governmental intervention.

**Figure B-1: Conceptual Relationship Among Energy Efficiency Potential Definitions**



Criterion 3.1. What types of energy-efficiency potential does the model calculate?

Criterion 3.1.a. Technical

1 – No.

2 – Yes.

Criterion 3.1.b. Economic

1 – No.

2 – Yes.

Criterion 3.1.c. Maximum Achievable

1 – No.

2 – Yes.

Criterion 3.1.d. Program Achievable (budget constrained)

1 – No.

2 – Yes.

Criterion 3.1.e. Naturally Occurring

1 – No.

2 – Yes.

#### 4. Baseline Energy Use

The focus of a potential study is on savings, but relative to what? It is easy, when dealing with end use, building type and measure level inputs, to lose sight of the fact that energy usage needs to add up to the energy supplied to customers by the utility. The potential modeling process must include steps or mechanisms that ensure that savings are being calculated from the correct baseline.

Criterion 4.1. Does the model construct or incorporate a baseline analysis that relates end use and building type inputs and assumption to utility energy sales?

1 – The model does not explicitly include a baseline calculation. A baseline may be calculated outside the model.

2 – The model contains a clear structure for calculating baseline energy use by end use and building type and balancing it against utility sales/peak.

3 – Unknown.

#### 5. Technical Potential

Technical potential is defined as the complete penetration of measures analyzed in applications where they are deemed technically feasible from an engineering perspective. In real life, measures penetrate the market gradually, as existing equipment stocks turn over and as customers become aware of and budget for retrofits. In a technical potential analysis, the

potential is calculated as if all eligible buildings adopted the measures immediately. Note that technical potential does not consider whether measures are cost effective, only that they are technically feasible. Cost effectiveness metrics are often developed in the technical analysis for application in the development of economic potential. Technical potential does not account for naturally occurring savings.

Inputs to the technical potential calculation include base energy use (absolute levels or intensities); cost and savings inputs; inputs that determine the eligible building stock, such as building stocks by building type, measure applicability, feasibility, and current penetration of high-efficiency measures; and load shapes.

### 5.1 Savings Representation

Potential models can specify model energy savings as either a percent or as a level. For example, a high efficiency refrigerator could modeled as saving 10 percent or it could be modeled as saving 64 kWh per year. If the base measure is one refrigerator, and a typical refrigerator uses 640 kWh per year, the two approaches are equivalent. However, if the base measure is “household refrigeration” and the average household has 1.1 refrigerators, the two methods diverge. In the level approach, special care must be taken that the savings are and remain consistent with the base unit (e.g. household savings with household energy; unit savings for a specified capacity unit with baseline energy use for a unit of the same capacity). The percent approach is more flexible, in that it scales with the number of refrigerators or with baseline energy.

Criterion 5.1a. How are savings represented in the model?

- 1 – As a level (e.g. kWh/unit or therms/sq ft).
- 2 – As a percent
- 3 – Other. Specify \_\_\_\_\_
- 4 – Unknown

Criterion 5.1b. If the savings are given as levels, are they checked against the baseline to see if they make sense?

- 1 – Savings are not checked against the baseline within the model. If any checks are to be performed they must be done by an analyst outside the model.
- 2 – The model contains mechanisms to compare savings levels to baseline energy to ensure that savings assumptions are reasonable.
- 3 – N/A.
- 4 – Unknown.

## 5.2 Relation of Costs and Savings

Costs and savings are often derived from different sources and expressed in different units. For example, costs for commercial lighting are typically given in cost per fixture, while savings could be expressed in kWh per square foot. For the analysis, we would need to know the number of fixtures per square foot. Residential refrigerators might have costs entered in dollars per refrigerator, while savings are kWh per household. The connecting data required would be number of refrigerators per household. With that data, the model can calculate cost in dollars per household and correctly compare it to savings per household.

Criterion 5.2. Does the model explicitly relate cost units to savings units?

- 1 – No. Costs and savings must be entered into the model on the same basis.
- 2 – Yes. The model has a mechanism or input that relates cost units to savings units.
- 3 – Unknown. Cannot determine how cost units relate to savings units.

## 5.3 Incorporation of Dynamic Elements

All models abstract from reality, and they may differ in the degree of complexity admitted for certain inputs. One aspect which is frequently simplified, is having a single set of inputs for measure cost, savings, etc. that applies to all years of the forecast. This assumption simplifies the structure of the model, but limits the models flexibility in addressing certain measures and situations. Emerging technologies, for example, are often characterized by falling prices as the technology becomes better established. Without time-varying costs, the modeler must choose to use the current cost, which may cause the technology to fail the cost-effectiveness screen, or to develop an estimate of future costs, which would overstate the equipment's current cost-effectiveness.

Another example where fixing inputs over time can be problematic is when addressing markets that are evolving rapidly. Consumer electronics are one area of concern, particularly recent developments in TVs, with CRTs being supplanted by plasma and LCD sets (with different energy characteristics), the recent commercialization of 3-D TVs, and an overall increase in saturation in the number of TVs per home. Setting parameters based on the current market may result in an inaccurate forecast 10 years out.

Criterion 5.3. Does the model incorporate dynamic elements, allowing measure inputs to vary over time (e.g. an expected increase in the saturation of plasma TVs, or an appliance standard that will begin in one year, but be ratcheted down to a lower level a few years in the future, or cost for an emerging technology fall over time)?

- 1 – No. The model has no dynamic elements.
- 2 – Partially. Energy costs and building stocks vary over time but other inputs do not vary
- 3 – Partially. The model allows some key model inputs to vary, but not all.

4 – Yes. All major inputs to the model are allowed to vary over time.

#### 5.4 Incorporation of Codes and Standards

Many products (notably HVAC, lighting, and appliances) are subject to minimum efficiency standards, either at the federal or state level. Standards complicate the analysis in several ways. When a new standard goes into effect, there is a difference between the efficiency of the equipment stock and the efficiency of new units until the entire stock has turned over. For replace on burnout measures, where the choice is between a new standard unit and a new high-efficiency unit, it is appropriate to use the energy use of new equipment as a baseline, and therefore to compare to the standard. But for retrofit measures (implemented before the end of life of the old equipment), savings are compared to existing equipment, which in a multi-year forecast is a moving baseline.

There are codes and standards at the federal or state level for many products. In general, standards already in effect should be accounted for in the model assumptions for equipment efficiency baselines. However, it is often the case that a change to codes and standards is approved (or anticipated) and will go into effect at a future date. These standards should be modeled or somehow addressed, since they will often take away a significant portion of the savings available to one or more measures being modeled. For example, the upcoming lighting standards are phasing in with an approximately 28 percent reduction in wattage between 2012 and 2014, with a steeper reduction following in 2020. A simple model will not capture the standard accurately.

Another complication is standards which either have been finalized but have not gone into effect (e.g. the phaseout of incandescent lamps), or that are anticipated (based, e.g., on the Department of Energy's standards process) to go into effect during the forecast period.

Criterion 5.4a. Can the model account for recent and known future changes to codes & standards?

- 1 – The model lacks the ability to address codes & standards.
- 2 – Codes and standards can be addressed only by manipulating the measure inputs on an ad hoc basis
- 3 – The model has mechanisms built in to address codes & standards.

Criterion 5.4.b. What codes and standards does the study model?

List codes & standards \_\_\_\_\_

Criterion 5.4.c. Are they modeled correctly?

- 1 – Partially. The modeling of the codes and standards is imprecise or inaccurate, resulting in a poor estimation of their impact

2 – Yes. The way the codes and standards are modeled will result in a good estimate of their impact.

3 – N/A. No Codes and standards are modeled.

### 5.5 Double Counting Savings Affecting the Same Base Energy Use

Efficiency measures are not independent of one another. In some cases, multiple efficiency measures may be applied that affect the same end use, such as ceiling insulation and a high efficiency furnace. If the insulation is installed first, the house will require less heat output from the furnace, thus reducing the savings of a subsequent high-efficiency furnace replacement. Assigning each measure its full savings results in double counting. One way to address this is to apply the measures sequentially in a pre-determined order (e.g. based on TRC). Another approach is to calculate the savings for the measures individually and the combined savings if all applicable measures are applied simultaneously. The combined savings can then be pro-rated to the individual measures, netting out double-counting. There may be other viable approaches; the key issue is whether double counting is addressed, and whether the approach is effective.

Criterion 5.5. Does the model have a mechanism to prevent double counting of measure savings when more than one measure affects the same base energy use?

1 – The model has no mechanism to prevent double counting of measure savings.

2 – Partially. The model attempts to address double counting, but the approach is flawed.

3 – The model fully addresses double counting.

4 – Unknown.

### 5.6 Double Counting Savings of Competing Measures

A second form of double counting comes when there are competing measures being analyzed, such as a high-efficiency standard water heater and a heat-pump water heater. Competing measures require special attention when both are cost effective (taken individually). Implementing the measure with the higher savings may or may not be the optimal (lowest marginal cost) choice. Again, there is more than one way to address this. One options is to apply the lower cost measure first, then ask whether the incremental cost and savings of the second measure (relative to the first measure) justify the additional investment in energy efficiency. In some cases it may make sense to segment the market, and apply each competing measure to a different segments. While it is possible to drop the intermediate measure from the analysis to maximize savings, this results in a higher marginal cost than the stair-step approach.

Criterion 5.6. Does the model have a mechanism to prevent double counting of measure savings when two measures are in competition with one another (i.e. only one technology could be installed in a given application)?

1 – The model has no mechanism to prevent double counting of measure savings.

- 2 – Partially. The model attempts to address double counting, but the approach is flawed.
- 3 – The model fully addresses double counting.
- 4 – Unknown.

## 6. Economic Potential

Economic potential is the technical potential of only those measures that are cost-effective when compared to supply-side alternatives. A cost-effectiveness test is performed for each measure in the analysis (e.g. is the Total Resource Cost ratio greater than one). Then the technical potential of all the measures passing the test is added together to calculate the overall economic potential. Some measures may be cost effective in some building types, but not in others. In that case, only the technical potential for the building types where the measure passed would be included.

There are a variety of cost effectiveness metrics, each of which has a different boundary for which types of costs and benefits are included when evaluating measures. The total resource cost (TRC) test compares the present value of costs for both participants and program administrators to the present value of benefits, including avoided energy supply and demand costs. The societal cost test (SCT) is similar to the TRC test, but includes the monetary value of externalities (such as emissions impacts). The ratepayer impact (RIM) test evaluates the impact on customer rates by changes in utility revenues and costs. The utility, or program administrator, cost test looks only at the impacts of the efficiency initiative on the utility (ignoring costs and benefits to participants), while the participant cost test does the opposite, looking only at participant costs and benefits while ignoring costs and benefits to the utility.

Criterion 6.1a. What cost-effectiveness test is used to screen measures for inclusion in economic or program potentials?

- 1 – Utility Cost Test.
- 2 – Participant Cost Test.
- 3 – Ratepayer Impact Test (RIM).
- 4 – Total Resource Cost Test (TRC).
- 5 – Societal cost test (SCT)
- 6 – Multiple tests. Specify\_\_\_\_\_
- 7 – Other. Specify\_\_\_\_\_
- 8 – Unknown.

Criterion 6.1b. Does the model calculate other cost-effectiveness metrics beyond the one used for screening?

- 1 – No.

2 – Yes. Specify \_\_\_\_\_

## 7. Maximum Achievable Potential

Maximum achievable potential taken into account a number of factors that prevent the full economic potential from being achieved.

One factor is that a small subset of customers are extremely resistant to adopting new technologies, even when they are cost effective, and even when there is an incentive to do so. This subset may include people or businesses that are difficult to reach with information and marketing, and do not seek out energy-efficiency information on their own, and so continue to do things the way they have always been done. It may also include those who dislike or distrust new technologies, whether from personal experience, stories they have heard, or any other reason. The economic potential for these customers is considered “not achievable.”

The term maximum achievable is usually used in the context of potential studies to mean the maximum that could be achieved through utility programs. One factor in this potential is whether there are other efforts or programs that are also working to achieve savings. These efforts could include building codes and appliance efficiency standards. There is also naturally occurring investment in energy efficiency, which can be motivated by social factors, customers seeking to save money, or market factors (improving performance or declining price of an energy efficiency technology.) The saving occur, but the question of attribution arises.

Maximum program achievable can therefore be thought of as

$$\begin{array}{ccccccc} \text{Maximum} & & & & & \text{Expected} & \text{Savings} \\ \text{Program} & = & \text{Economic} & - & \text{Not} & - & \text{Expected} \\ \text{Achievable} & & \text{Potential} & & \text{Achievable} & & \text{Savings} \\ \text{Potential} & & & & \text{Savings from} & - & \text{Expected from} \\ & & & & \text{Standards} & & \text{Outside of} \\ & & & & & & \text{Building} \\ & & & & & & \text{Codes} \\ & & & & & & \text{Programs or} \\ & & & & & & \text{Codes} \end{array}$$

Criterion 7.1. Does the estimate of maximum program achievable take into account the following factors?

Criterion 7.1.a. Not achievable savings.

1 – No.

2 – Yes.

Criterion 7.1.b. Expected Savings from Standards

1 – No.

2 – Yes.

Criterion 7.1.c. Expected Savings from Building Codes

1 – No.

2 – Yes.

Criterion 7.1.d. Expected Savings from Outside of Programs, Standards and Codes  
(Naturally Occurring)

1 – No.

2 – Yes.

Criterion 7.1.e. Other. Specify \_\_\_\_\_

1 – No.

2 – Yes.

## 8. Program Potential (Market Potential)

Where technical and economic potential assume 100 percent measure penetrations into the eligible populations, program potential (a.k.a program achievable potential, market potential or budget-constrained potential) needs to consider the size of the incentives offered, market barriers to each measure, cost effectiveness of each measure, customer awareness, etc., in determining the actual percent market penetration.

### 8.1 Approach to Measure Penetration

Market penetration of measures can be incorporated in the model using technology adoption curves, or calculated by the model as function of incentive level and measure cost effectiveness. It can also be done through expert judgment, or it can explicitly leverage the program experience of one or more utilities to predict program impacts.

Each approach has its advantages and disadvantages. The modeling approach makes penetration a function of incentive levels, cost effectiveness, etc., so the process is automated and adjustments to each factor will change the penetration in a clear and predictable fashion. This makes it straightforward to run alternative scenarios (e.g. different incentive levels or different avoided cost forecasts). However, in practice, many of the necessary parameters are unknown: customer awareness, market barriers (introduced in the form of parameters of a technology adoption curve). The modeler needs to calibrate these parameters to create plausible results, which introduces elements of expert judgment, despite the effort to divorce the process from human opinion and human error.

Expert judgment of course hinges on the knowledge and experience of the expert. It can be inconsistent (one expert may judge differently from another expert, or she may change her opinion over time). If the characteristics of the program change (e.g. higher or lower incentives), the penetration estimates must be revised; there is no mechanism for them to update automatically. However, the method is straightforward and transparent, and the penetrations can be revised directly if issues arise (in contrast to the modeling approach where one must

figure out whether customer awareness needs to be increased or decreased or if some other parameter should be changed instead).

The experience of utility programs ultimately informs both expert judgment and the calibration used in the modeling approach. However, some potential models have been explicit in using this type of data. The advantages of this approach lie in the use of empirical data and in clear documentation. The downside is that utility experiences can be quite diverse, even with program and measures that seem very similar on the surface. Customers, and market barriers, differ from region to region. Program marketing approaches may differ, even with similar budgets, resulting in very different participation. And, as with expert judgment, the approach may not easily accommodate changes to incentive levels or other program parameters.

Criterion 8.1. How is measure penetration determined in the program achievable analysis?

- 1 – Measure penetration is an input to the model based on expert judgment or penetrations from other studies.
- 2 – Measure penetration is explicitly based on data on utility program experience from one or more utilities.
- 3 – Calculated by the model as a function of the incentive level, measure cost effectiveness, and/or other inputs.
- 4 – Other. Specify \_\_\_\_\_
- 5 – N/A. Not Applicable (e.g. the model does not calculate program achievable potential).

## 8.2 Incorporation of Incentive Level Assumptions

Market penetration should typically increase as incentive levels increase (as the utility pays a larger share of the incremental cost, the consumer pays a smaller share). Because utilities frequently use potential models to assess the impacts of different program structures and incentive levels, the potential model should be able to accommodate changing incentive levels, and address how those changes would impact market penetration, in an organized and efficient way.

Criterion 8.2. Can the approach to market penetration in the program achievable case accommodate changes in incentive levels in a consistent and organized manner?

- 1 – No.
- 2 – Partially.
- 3 – Yes.
- 4 – N/A.

### 8.3 Incorporation of Customer Awareness Assumptions

Another key factor in determining market penetration is customer awareness. Customer awareness varies significantly from measure to measure. Utility programs increase awareness of energy-efficiency measures through marketing efforts (bill inserts, in-store information, through account executives, etc.). Some programs may be designed as education or information-only programs, with no direct incentive. The effects of marketing efforts and customer awareness should be addressed.

Criterion 8.3. Can the approach to market penetration in the program achievable case accommodate changes in customer awareness in a consistent and organized manner?

- 1 – No.
- 2 – Partially.
- 3 – Yes.
- 4 – N/A.

### 8.4 Incorporation of Naturally-Occurring Savings

Even in the absence of efficiency programs, some customers would adopt energy-efficiency measures. This is referred to as naturally-occurring energy efficiency. These customers may take advantage of the program, even though they would have invested in the energy-efficient measure without it. Although a utility may take steps to exclude such “free riders” from incentive programs, it is almost inevitable that some incentive payments are made for “savings” which would have occurred even in the absence of the program. In utility program parlance, “gross savings” are the savings for all participants, including free riders; “net savings” are the savings with free riders excluded.

In calculating program achievable savings, it is not enough to calculate gross savings. A potential model should be able to calculate net savings. This may be done through something as simple as an assumed net-to-gross ratio, but more sophisticated approaches would look at naturally occurring as a function of cost effectiveness, awareness, etc.

Criterion 8.4. How does the model account for naturally-occurring energy efficiency and free ridership?

- 1 – The model does not address naturally-occurring energy efficiency.
- 2 – Naturally-occurring energy efficiency is addressed through one or more input parameters (net-to-gross ratio, free ridership, spillover, etc.).
- 3 – Naturally occurring investment in energy efficiency or free ridership is calculated by the model based on such factors as measure cost effectiveness and market barriers.
- 4 – N/A.

## 8.5 Incorporation of Alternate Scenarios

One frequent demand of potential models is to run “What If?” scenarios. What if the utility set incentives to 50% of incremental costs? What if it sets them to 75%? What if it increases the marketing budget? What if avoided costs follow this forecast instead of that one? Models should be flexible enough to accommodate these sorts of inquiries without undue investment of time and resources.

Criterion 8.5. Can the model be used to evaluate alternative program or avoided cost scenarios?

- 1 – No.
- 2 – Yes, but not easily.
- 3 – Yes, easily.

## 8.6 Incorporation of Program Costs

Program costs are typically divided into incentive costs (paid to participants) and administrative costs. Marketing costs are a subset of administrative costs that may be broken out, and are of interest because they drive awareness of the program and therefore participation.

Incentive costs are connected to participation. A model can either determine participation (based on cost effectiveness, barriers and incentive levels) and then determine the incentive budget needed to support that level of participation, or set the budget, and then determine how many participants it supports. The latter approach, used in practice, can result a program being suspended or terminated early due to insufficient funds.

If the program determines the incentive budget, it should also adjust administrative costs in proportion, or at least partly in proportion, to the incentive budget. A program that expands from \$50,000 to \$5 million in incentives cannot expect to keep its administrative costs constant. On the other hand, there may be some elements of administrative costs that are fixed, and do not increase with the incentive budget.

Criterion 8.6. How are program costs determined?

Criterion 8.6.a How are program incentive costs determined?

- 1 – They are an input to the model.
- 2 – They are an output of the model
- 3 – Incentive costs are not broken out in the model
- 4 – Unknown
- 5 – Not Applicable

Criterion 8.6.b How are program administrative costs determined?

- 1 – They are an input to the model, and not do not change with the incentive budget

- 2 – They are an output of the model, but do not change with the incentive budget, savings or participation
- 3 – They are an output of the model and are proportional to the incentive budget, savings or participation
- 4 – They are an output of the model and are part fixed, part proportional to the incentive budget, savings or participation
- 5 – Administrative cost are not broken out in the model
- 6 – Unknown
- 7 – Not Applicable

Criterion 8.6.c How are program marketing costs determined?

- 1 – They are an input to the model.
- 2 – They are an output of the model
- 3 – Marketing costs are not broken out in the model
- 4 – Unknown
- 5 – Not Applicable

## 8.7 Existing Building and New Construction Stock Accounting

Existing buildings and new construction must be modeled differently. Existing buildings accept three types of measures: retrofit, replace on burnout, and early retirement. Retrofit measures can be applied at any time; in theory, 100 percent of the building stock could adopt a measure in one year. Once the measure has been implemented in a particular building, that building is no longer considered part of the eligible stock. Adoption is limited by awareness, cost effectiveness, and market barriers.

In contrast, replace-on-burnout (ROB) measures are limited by the rate of equipment turnover (as units “burn out” and need replacing). These are considered “lost opportunity” measures, meaning that once the decision is made to use standard efficiency equipment, there will not be another opportunity to replace it with standard equipment until the newly purchased equipment reaches its natural end-of-life.

New construction measures are also considered lost opportunity measures. If the measure is not implemented at the time the building is constructed, it may not be possible to implement them (e.g. passive solar design), or possible only at a much higher cost (e.g. insulation). New construction also requires an entirely separate set of building inputs, which the model should accommodate.

Because of the different patterns of stock turnover and eligible stock, stock accounting is a critical element of potential models. First, so that buildings enter the eligible stock at the right

time, but also that they leave the eligible stock when an efficiency measure is installed or standard equipment is chosen on a ROB measure.

Criterion 8.7. Does the model perform stock accounting calculations correctly?

Criterion 8.7.a. Existing retrofit

- 1 – No.
- 2 – Yes.
- 3 – Cannot be Determined.

Criterion 8.7.b. Existing replace-on-burnout

- 1 – No.
- 2 – Yes.
- 3 – Cannot be Determined.

Criterion 8.7.c. Existing early retirement

- 1 – No.
- 2 – Yes.
- 3 – Cannot be Determined.

Criterion 8.7.d. New construction

- 1 – No.
- 2 – Yes.
- 3 – Cannot be Determined.

## 8.8 Calibration of Building Forecasts

In any estimate of efficiency potential associated with a particular time period, it is necessary to track both the rate of building decay (the rate at which buildings are torn down, abandoned, or receive a complete gut remodel) and the rate of new construction. The interaction of these two factors must result in a building forecast (in number of buildings, floor space or in some cases, base energy use, depending on the sector being analyzed) that is consistent with the utility's load forecast.

Criterion 8.8. Does the building forecast (existing building decay and new construction rates) take into account and calibrate to load forecasts?

- 1 – No. The model does not calibrate to load forecasts. Any calibration would have to be conducted on the model inputs, outside the model.

2 – Partially. The model attempts to calibrate, but the calibration does not produce a building forecast that is congruent with forecast loads.

3 – Yes. The model explicitly and correctly incorporates load forecasts

## 9. Consistency with other studies

The final criterion compares the model to models used by other California POU's and IOU's (recently or in the past). This comparison serves a two-fold purpose:

1. Consistency in approach assures that the approach has been vetted in past studies. While conventional and mainstream approaches are not necessarily "right" or "correct," they indicate that the methodology is accepted, where an entirely novel approach would require additional scrutiny.
2. Consistent methodology should make it easier to aggregate results to the state level, and to compare results between utilities.

Criterion 9.1 Is the general methodology of the model consistent with the models used by other California POUs and IOUs?

1 – No. The model has significant differences in approach from other California potential studies.

2 – Partially. The model uses an uncommon approach, but one that has been used in other studies.

3 – Partially. The model differs in small ways from other potential studies

4 – Yes. The methodology is similar to other potential studies

## Framework 2: Framework for Evaluating POU Energy Efficiency Potential Estimates

Energy efficiency potential studies provide data needed to support energy efficiency policies and programs, including the following activities:

- Setting attainable energy savings targets
- Quantifying the energy efficiency resource for system planning
- Determining funding levels for delivering energy efficiency programs
- Designing programs to achieve the long-term potential
- Reassessing energy efficiency opportunities as conditions change

The framework presented here provides a consistent, systematic approach to assess the energy efficiency potentials reported by the California publicly owned utilities (POUs). Most POU's utilized the CalEERAM model to estimate energy efficiency potential for their utility service area, with LADWP and SMUD utilizing their own potential models. Savings targets for the POU's are based on the potential estimates.

The objective of this review is to ensure that POU efficiency potentials, and therefore efficiency targets, are based on reliable inputs and that the potential models used by the POU's have been implemented correctly. The review will look at measure inputs, outputs, and assumptions that are specific to each POU's analysis. The structure of the models structure was evaluated using a separate framework, and will not be re-examined here. This framework was developed based on the National Action Plan for Energy Efficiency's Guide for Conducting Energy Efficiency Potential Studies and KEMA's extensive experience with efficiency potential studies.

This framework is accompanied by an Microsoft Excel based scoring template <Framework for Potential Estimated – Form.xls>, with a notes (description) field associated with each scoring criterion.

## 1. Reporting/Documentation Adequacy

### 1.1 Source of Model Inputs and Values

In order to evaluate the reasonableness of energy efficiency potential estimates, we need to understand the source of the model inputs and assumptions. Potential models take a wide range of inputs, including discount rates, inflation rates, line losses, rates, loadshapes or load factors, measure costs and savings, floorspace, etc. With so many inputs, usually coming from a wide range of sources, documentation can often be both challenging and time consuming.

Criterion 1.1a. Is there a source provided for model inputs and are assumed values properly documented?

- 1 – None. There is no documentation of any inputs.
- 2 – Low. There is documentation for some inputs, but not for many important inputs.
- 3 – Medium. Many inputs are documented, but there are significant gaps in the documentation of major inputs.
- 4 – High. There is documentation for most inputs and most major inputs are documented.
- 5 – Full. All model inputs seem to be documented.

Criterion 1.1b. Are the explanations and sources complete (e.g. full citations for published sources)?

- 1 – None. None of the sources or explanations provided are complete.
- 2 – Few. Less than 25% of the sources or explanations provided are complete.

- 3 – Some. 25 to 75% of the sources or explanations provided are complete.
- 4 – Most. More than 75% of the sources or explanations provided are complete.
- 5 – All. All of the sources or explanations provided are complete.

## 1.2 Reporting

Regardless of documentation (and especially in the absence of documentation), it is important to be able to review the actual input values that went into the potential estimate. These values should be accessible in the model itself, but they may also be included in the report documenting the potential study (e.g. in an appendix).

Criterion 1.2. Are key input data provided as part of the report?

- 1 – No. The report does not include values for major inputs.
- 2 – Some. The report includes values for some major inputs, but there are important omissions.
- 3 – Yes. The report documents values of major inputs.

## 2. Customer Disaggregation

### 2.1 Customer Sector

Potential studies usually look at energy use by sector (e.g. residential versus non-residential sector). This is because building characteristics and systems vary significantly between sectors, as do the applicable measures. Since utilities have separate residential and commercial and industrial (C&I) rates, sales are typically available at least at that level of disaggregation. Thus, many energy efficiency potential studies are organized in this manner. Disaggregating commercial from industrial can be more difficult, but provides useful detail, particularly when there is significant industrial usage. In rare studies, agriculture is considered as a separate sector. In scoring this criterion, the “other” category can be used to indicate the inclusion of the agricultural sector or other sectors.

Criterion 2.1. What sectors are included in the study?

Criterion 2.1a. Residential?

- 1 – No.
- 2 – Yes.

Criterion 2.1b. Commercial (separate from industrial)?

- 1 – No.
- 2 – Yes.

Criterion 2.1c. Industrial (separate from commercial)?

- 1 – No.

2 – Yes.

Criterion 2.1d. Nonresidential (commercial and industrial combined)?

1 – No.

2 – Yes.

Criterion 2.1e. Other?

1 – No.

2 – Yes. Specify \_\_\_\_\_

## 2.2 Building Types within Customer Sectors

Energy use can also vary significantly across building types within each customer sector. For example, cooking is a significant end use in restaurants, and to a lesser extent in grocery stores, but not very important in other building types, and usage varies significantly. Often, a measure can be cost effective in one building type (with high usage/savings), but not another. The more disaggregated the study, the better the chance that the study will capture all available savings. However, the flip side of greater disaggregation is a greater data burden. Ultimately, the degree of disaggregation is limited by both the study budget, time to complete the study, and the amount of data available at a disaggregated level.

The number of building types analyzed represents one metric of the degree of disaggregation of a study.

- Residential sector: Note that low income, while not a building type, is often treated as one in potential studies. This is because many utilities have targeted low income programs. These programs often include home weatherization and giveaways of equipment like CFLs.
- Commercial sector: The building types included below are based on the CEC defined building types for its energy forecasting, as documented in the Energy Demand Forecast Methods Report from June 2005.
- Industrial sector: The following criterion lists the “building types” (i.e. industries) used for the development of the CEC industrial energy forecasts. This certainly does not represent the only way of breaking out industrial. Note that the CEC list has some groups at the 4-digit NAICS level, and others at the 3-digit level. Many studies do not disaggregate beyond the 3-digit level. The two-digit level is too aggregated to say anything meaningful about specific industries. The “Other” field can be used to describe breakdowns that were done at a higher or lower level of aggregation than the CEC bins.

The following three questions address the number and types of buildings analyzed for the residential, commercial and industrial sectors, respectively. The reviewer should indicate the building types included in the potential model for each customer sector.

Criterion 2.2a. How many residential building types are included in the study?

Number of residential building types: \_\_\_\_\_

Which types (mark with X)?

☐ Single Family

☐ Multifamily

☐ Mobile Home

☐ Low Income

☐ Other. Specify: \_\_\_\_\_

Comments \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

Criterion 2.2b. How many commercial building types are included in the study?

Number of commercial building types: \_\_\_\_\_

Which types (mark with X)?

☐ All Offices

☐ Large Offices

☐ Small Offices

☐ Retail

☐ Restaurant/Food Service

☐ Grocery/Food/Liquor Store

☐ All Warehouses

☐ Refrigerated Warehouses

☐ Unrefrigerated Warehouses

☐ Education (K-12, college, other schools combined)

- ☐ School (K-12)
- ☐ College/Trade School
- ☐ Health/Hospital
- ☐ Lodging/Hotel/Motel
- ☐ Miscellaneous
- ☐ Other. Specify: \_\_\_\_\_

Comments \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

Criterion 2.2c. How many industrial building types (or industries) are included in the study?

Number of industrial building types: \_\_\_\_\_

Number of other building types: \_\_\_\_\_

Which types (mark with X)?

- ☐ Logging and Wood Product Manufacturing (NAICS 1133, 321)
- ☐ Oil and Gas Extraction & Support Activities (NAICS 211, 213)
- ☐ Other Mining (NAICS 212)
- ☐ Construction (NAICS 230)
- ☐ Food Processing (NAICS 3113, 3114)
- ☐ Paper Manufacturing (excluding pulp, paper and paperboard mills) (NAICS 322x)
- ☐ Pulp, Paper, and Paperboard Mills (NAICS 3221)
- ☐ Petroleum and Coal Products Manufacturing (NAICS 324)
- ☐ Glass Manufacturing (NAICS 3272)
- ☐ Cement (3273)
- ☐ Food and Beverage (excluding food processing) (NAICS 311x, 312x, excluding 3113, 3114)
- ☐ Textile Mills NAICS (313)
- ☐ Textiles Product Mills (NAICS 314)

- ☐ Apparel and Leather Products Manufacturing (NAICS 315, 316)
- ☐ Printing and Related Support Activities (NAICS 323)
- ☐ Chemical Manufacturing (NAICS 325)
- ☐ Plastics and Rubber Products Manufacturing (NAICS 326)
- ☐ Nonmetallic Mineral Product Manufacturing (excluding glass and cement (NAICS 327x excluding 3272 and 3273)
- ☐ Primary Metal Manufacturing (NAICS 331)
- ☐ Fabricated Metal Product Manufacturing (NAICS 332)
- ☐ Machinery Manufacturing (NAICS 333)
- ☐ Computer and Electronic Product Manufacturing (excluding Semiconductor and other electronic component manufacturing) (NAICS 334x excluding 3344)
- ☐ Semiconductor and Other Electronic Component Manufacturing (NAICS 3344)
- ☐ Electrical Equipment, Appliance, and Component Manufacturing (NAICS 335)
- ☐ Transportation Equipment Manufacturing (NAICS 336)
- ☐ Furniture and Related Product Manufacturing (NAICS 337)
- ☐ Miscellaneous Manufacturing (NAICS 339)
- ☐ Publishing and Broadcasting Industries (NAICS 511, 516)
- ☐ Miscellaneous Manufacturing
- ☐ Agriculture
- ☐ Crop Production/Irrigation Water Pumping
- ☐ Dairy and Livestock Production
- ☐ Domestic Water Pumping
- ☐ Water/WW
- ☐ Other. Specify: \_\_\_\_\_

Comments \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

## 2.3 End Use Intensity within Building Types

Energy use by end use also varies significantly within building types. Further disaggregation of end use energy intensity will account for businesses and homes with above average usage, for example by explicitly breaking out customers within a building type by energy use into high, medium and low users. Some of these sub-sectors will have increased savings potential in less cost-effective measures. If a potential study does not account for this variation, and excludes all savings from measures which fail the TRC test based on average energy intensity, then it is systematically understating the economic and achievable levels of potential. Analyzing subsectors requires additional data, effort and cost, but the benefit is a more accurate representation of the potential. The effort required to conduct an analysis of this granularity will vary substantially across utilities.

Criterion 2.3. Is end use intensity further disaggregated, beyond the above-mentioned building types?

Criterion 2.3a. Residential?

1 – No.

2 – Yes. Describe: \_\_\_\_\_

Criterion 2.3b. Commercial (separate from industrial)?

1 – No.

2 – Yes. Describe: \_\_\_\_\_

Criterion 2.3c. Industrial (separate from commercial)?

1 – No.

2 – Yes. Describe: \_\_\_\_\_

## 3. Measures

### 3.1 Major End Uses

Building energy use is typically categorized into a number of broad end-use groupings. The end-use groupings are used to refer to similar energy consuming measures and equipment. For example, the major end uses for each customer sector are:

- Residential end-uses include space cooling, space heating, lighting, water heating, refrigeration, appliances, cooking, consumer electronics, pool pumps, and miscellaneous.

- Major commercial end uses include indoor and outdoor lighting, space cooling, ventilation, refrigeration, water heating, office equipment, cooking, space heating and miscellaneous.
- Industrial end uses include compressed air, fans, pumping, drives, process heating, refrigeration, other process, cooling, lighting, and other.

Criterion 3.1. Are any major end uses omitted from the study?

1 – Yes. Specify \_\_\_\_\_

2 – No.

### 3.2 Measure within End Uses

A study that includes too few measures may miss some technical or economic potential

that might have been captured with a more exhaustive measure list. However, expanding the measure list to new and emerging technologies often ends up capturing technologies that are not yet cost effective, due to high costs (due to an immature market) or savings or performance that don't yet live up to the promise of the technology. This has the effect of increasing technical potential without increasing economic potential.

Including too many measures may also introduce redundancies when groups of measures have similar costs and savings. When this happens, the similar measures don't add any additional savings, as the slightly more cost-effective measure of the group will capture the available energy savings potential in the end-use in question. The analytical resources used up by this situation are better used elsewhere in the modeling process.

The goal, therefore, is to develop a list of representative measures that includes all key measure types that might be cost effective under plausible avoided cost scenarios and that have the possibility of a reasonable level of savings. Measures already offered by the utility's existing efficiency programs should be included the study. The potential study should also include any new program measures under consideration, as well as other new and emerging technologies of interest to the utility and stakeholders.

Larger measure lists require more data collection, so study budgets may limit the number of measures considered. Sometimes, promising measures are excluded because complete, reliable data about costs, savings and applicability cannot be found.

The number of measures provides one metric to compare between studies.

Criterion 3.2. How many measures are included in the study?

Number of residential measures: \_\_\_\_\_

Number of commercial measures: \_\_\_\_\_

Number of industrial measures: \_\_\_\_\_

Number of C&I measures (if C&I combined in study): \_\_\_\_\_

Number of measures for other building types: \_\_\_\_\_

### 3.3 Energy Efficiency Categories for Measures

Even an extensive measure list may be inadequate if it does not cover most of the available energy efficiency opportunities. Measures can be grouped in the following types of energy efficiency categories:

- High efficiency equipment (e.g. high-efficiency furnace, boiler, water heater, central air conditioner, chiller, direct-expansion (DX) unitary HVAC system, etc.). A study may consider multiple efficiency levels at different price points.
- High efficiency equipment with indirect effects. Water heating loads are affected by the efficiency of hot-water-using equipment, such as clothes washers and dishwashers. A higher efficiency clothes washer may save energy both in the energy of the clothes washer itself and through reduced water heating energy.
- Alternative high efficiency technologies (e.g. tankless water heater, solar water heater, geothermal heat pump, evaporative cooler). Not just a higher efficiency level of the same basic technology, but an entirely different technology.
- Controls (e.g. programmable thermostat, EMS, occupancy sensors, dimmers, daylighting controls, process controls, etc.). Most of these change the hours of use, but may (like dimmers) change the power level.
- Shell measures (e.g. windows, insulation, cool roofs). These reduce the heating or cooling load by reducing thermal gains or losses through the building envelope.
- Heat recovery (stack heat exchangers, heat recovery from ventilation, etc.). Heat can be lost from a building when heated air or water leaves the building (e.g. exhaust air, combustion gases, or drain water). Heat exchangers can be used to capture the heat from these sources and use it for some useful purpose.
- Operations and maintenance practices. These may include systems tune-ups, calibration of systems controls, refrigerant charge, etc. These measures often have no materials cost, only labor costs.

Without applying a measure checklist, which we feel would be overly restrictive, we want to assess in a general way whether the measure list contains any major omissions.

Criterion 3.3. Does the measure list cover most of the available energy efficiency opportunities?

1 – No. The measure list omits many measures which one might expect to be cost effective. Describe significant omissions \_\_\_\_\_

\_\_\_\_\_

2 – Partially. The measure list captures a lot of the expected energy efficiency opportunities, but some key measures are missing. Describe significant omissions \_\_\_\_\_

3 – Yes. The measure list appears fairly comprehensive. To the extent that measures are omitted, they are marginal (in terms of savings potential, availability, or cost effectiveness)

### 3.4 Emerging Technologies

Potential studies often work with relatively long time frames—10 years or more. Over 10 years, new products may be introduced, and products that are currently considered exotic or risky may become mainstream. A potential study that focuses only on established technologies may therefore undercount savings.

However, modeling new technologies is problematic because of the inherent uncertainties in forecasting commercial viability, market acceptance, product performance, and product costs at the manufacturing scales. These technologies may be modeled separately and explicitly as a scenario, in which case studies and expert judgment or interviews are used to compensate for the lack of rigorous documentation of market performance. If this is not done, emerging technologies have the effect of increasing technical potential without increasing economic potential, since high costs resulting from an immature market often make them not yet cost effective.

Utilities modeling potential in order to set efficiency targets at the behest of regulators often want to avoid emerging technologies, with good reason. If emerging technologies are treated on the same footing with mature technologies, the result could be targets that are difficult or impossible to meet. Utilities understandably want to avoid this situation, and thus unfortunately often want to avoid modeling emerging technologies at all. The problem can be avoided if emerging technologies are modeled separately from established technologies, and the uncertainty in the emerging technology scenario is communicated to stakeholders so that the results are not used to drive current goals.

The following two questions attempt to assess how aggressive the study was in including new and emerging technologies

Criterion 3.4. Does the measure list include technologies that are not yet widely commercially available?

1 – No.

2 – Yes. Specify \_\_\_\_\_

Criterion 3.4a. How aggressive was the utility in including emerging technologies in the study?

1 – Some technologies in the early adoption phase were included.

Specify: \_\_\_\_\_

2 – Some technologies in the demonstration phase were included

Specify: \_\_\_\_\_

Criterion 3.4b. What methodology was used to inform the emerging technologies assumptions in the study?

1 – Case studies.

2 – Expert interviews

3 – Expert judgment

Criterion 3.4c. Were the emerging technologies modeled as a separate scenario?

1 – No

2 – Yes

Criterion 3.4d. Was the nature of this scenario presented appropriately?

1 – No

2 – Yes

#### 4. Measure Cost Inputs

##### 4.1 Measure Costs from DEER

We expect that the POUs will overwhelmingly use DEER inputs for the majority of measures included in the potential studies. According to the DEER website:

The Database for Energy Efficient Resources (DEER) is a California Energy Commission and California Public Utilities Commission (CPUC) sponsored database designed to provide well-documented estimates of energy and peak demand savings values, measure costs, and effective useful life (EUL) all with one data source. The users of the data are intended to be program planners, regulatory reviewers and planners, utility and regulatory forecasters, and consultants supporting utility and regulatory research and evaluation efforts. DEER has been designated by the CPUC as its source for deemed and impact costs for program planning.

DEER is generally considered one of the industry standards for cost-benefit data associated with energy efficiency measures.

Criterion 4.1. Does the model use cost inputs from DEER appropriately?

- 1 – No. There are significant problems with how DEER cost inputs are used in the model.
- 2 – Partially. Most DEER cost inputs seem to be used appropriately, but some appear to be misused.
- 3 – Yes. DEER cost inputs are used appropriately
- 4 – NA. DEER cost inputs are not used
- 5 – Unknown. There is not enough information to assess whether costs are appropriate.

#### 4.2 Measure Costs Not from DEER

Potential studies may include measures not included in DEER, necessitating that inputs be found from other sources. A utility may also find that some DEER inputs are inappropriate for some reason (e.g. local variation in labor costs or product availability). In the latter case, deviations from available DEER inputs should be documented.

Criterion 4.2. For cost inputs not from DEER, do the costs generally appear to be reasonable?

- 1 – No. There are significant problems with non-DEER cost inputs.
- 2 – Partially. Most non-DEER cost inputs seem reasonable, but some appear questionable.
- 3 – Yes. Non-DEER cost inputs appear to be reasonable
- 4 – All cost inputs are from DEER
- 5 – Unknown. The costs appear questionable and there is not enough information to assess whether costs are appropriate.

#### 4.3 Measure Cost – Incremental or Full Cost

Depending on the type of measure, the modeler may want to use the full measure cost

or the incremental measure cost. For a replace-on-burnout (ROB) measure, incremental costs should be used. This is because at the time of purchase of the high efficiency equipment, the purchaser is making a choice between buying standard or high efficiency equipment (the old equipment having “burned out”). Therefore, the cost of the standard equipment must be spent regardless, and the incremental expenditure to purchase the higher efficiency unit is the appropriate cost. In the case of a retrofit, the decision is to make no changes to the existing equipment or building (no cost) or to perform the retrofit. Since the alternative has no first cost, the full cost of the measure must be considered.

Criterion 4.3. Are costs consistent with the measure applications (incremental for ROB, full cost for retrofit)?

- 1 – No. Many measures, both retrofit and ROB, seem to have inappropriate costs.

- 2 – Partially. The type of cost is correct for ROB, but not retrofit measures.
- 3 – Partially. The type of cost is correct for retrofit, but not ROB measures.
- 4 – Partially. The type of cost is incorrect for a few measures (but doesn't align with retrofit or ROB measures).
- 5 – Yes. The type of cost agrees with the measure type for all measures.
- 6 – Unknown. There is not enough information to assess whether costs are appropriate.

#### 4.4 Measure Cost Alignment with Other Values

When calculating cost effectiveness, savings must align with costs explicitly in the inputs or they must be aligned within the model. That is, if savings are expressed as savings per household, then costs must also be in cost per household. If costs and savings are input on a different basis, say savings per household, but costs are per unit, then it is critical that the model have some way to align the two, such as the number of units per household.

Criterion 4.4. Are costs lined up with savings in an appropriate manner?

- 1 – No. There are many instances where costs and savings do not align.
- 2 – Partially. There are a few instances where costs and savings do not align.
- 3 – Yes. Cost and savings inputs are all entered on the same basis (e.g. per sq. ft.)
- 4 – Yes. The model includes a mechanism to align costs and savings when they are entered on a different basis, and it is implemented correctly
- 5 – Unknown. There is not enough information to compare cost units with savings units

### 5. Measure Saving Inputs

#### 5.1 Measure Savings from DEER

We expect that the POUs will overwhelmingly use DEER savings inputs for the majority of measures included in the potential studies. DEER is described in the discussion for question 4.1.

Criterion 5.1. Does the model use measure savings inputs from DEER appropriately?

- 1 – No. There are significant problems with how DEER savings inputs are used in the model.
- 2 – Partially. Most DEER savings inputs seem to be used appropriately, but some appear to be misused.
- 3 – Yes. DEER savings inputs are used appropriately
- 4 – DEER savings inputs are not used

5 – Unknown. There is not enough information to assess whether savings are appropriate.

## 5.2 Measure Savings Not from DEER

Potential studies may include measures not included in DEER, necessitating that inputs be found from other sources. A utility may also find that some DEER inputs are inappropriate for some reason (e.g. different business hours or work schedule in the community). In the latter case, deviations from available DEER inputs should be documented.

Criterion 5.2. For savings inputs not from DEER, do the savings generally appear to be reasonable?

1 – No. There are significant problems with non-DEER savings inputs.

2 – Partially. Most non-DEER savings inputs seem reasonable, but some appear questionable.

3 – Yes. Non-DEER savings inputs appear to be reasonable

4 – All savings inputs are from DEER

5 – Unknown. There is not enough information to assess whether savings are appropriate.

## 5.3 Weather Sensitive Measure Savings

Savings for many measures vary depending on weather and climate. Heating and cooling measures are typically regarded as weather sensitive, while other measures are not. Water heating is somewhat weather sensitive, due to variation in groundwater temperature and to a lesser extent ambient temperature, but the differences are small and typically not modeled in potential studies. For instance, a potential study done for coastal California should use very different cooling savings than one done for Phoenix, Arizona.

Criterion 5.3. Are weather-sensitive savings appropriate to the climate zone(s) of the POU?

1 – No.

2 – Yes.

## 5.4 Codes and Standards Effects

Codes and standards, which can be implemented at the federal or state level, take away some of the savings which would otherwise be available to be captured by an efficiency program. For example, forthcoming lighting standards require a minimum efficacy that is 30 percent better than standard incandescent lamps. Once the standard goes into effect (staggered from 2012 to 2014), the savings for measures that replace incandescent lamps, like CFLs, will go down.

Regardless of whether a potential model has the structure to properly model the effects of codes and standards, that functionality must be correctly exploited when measure data is entered in creating potential estimates.

Criterion 5.4. Does the model properly address the upcoming lighting standards, for example in modeling savings for CFLs?

1 – No. The model includes measure that will be affected by the standard, but savings are not adjusted.

2 – No. The model does not include any measures that would be affected by the lighting standard.

3 – Yes. Savings are adjusted properly for the effects of the standard.

Criterion 5.4.a. Are any other measures adjusted for the effects of codes and standards?

1 – No.

2 – Yes. Specify \_\_\_\_\_

## 5.5 Peak Demand Savings Consistency with Energy Savings

Potential studies typically address peak demand reductions in addition to energy savings, as avoided energy costs vary across the different times of the day (i.e. time-of-use). Similarly, total hourly energy consumption for a specific end use varies over each hour of the year. This variation of hourly consumption over the year is represented by the end use's loadshape. The end use's loadshape represents what fraction of annual energy consumption occurs in each hour (or other time period) of the year. Applying 8760-hour-per-year loadshapes directly to a potential model would be extremely data intensive. Instead, the detailed loadshape data can be used to derive time-of-use and coincidence factors at a higher level of aggregation, for example by defining time periods as summer peak, summer off-peak, winter peak, winter off-peak. These factors can then be used to allocate energy savings to different time-of-use periods and to estimate peak demand from energy use and savings.

For measures that operate at a constant demand (kW) for all 8760 hours per year, the ratio of energy to peak demand would be 8760 kWh per kW. For most end uses, the ratio of energy to demand should be significantly less, since few end uses run full bore all year. For end uses that tend to be operated coincident with system peak (such as cooling), there would be a lower energy to demand ratio. For end uses that are used primarily off peak, such as outdoor lighting, the coincident energy to peak ratio would be higher than 8760, since its operation pattern is almost counter to system loadshapes.

Criterion 5.5. Are peak demand savings consistent with energy savings?

1 – No.

2 – Yes.

### 5.6 Peak Demand Savings Use of Load Shapes

Different measures affect peak demand differently. Some save energy in equal percentages over peak and off-peak periods. Others save energy disproportionately during peak periods (e.g. daylighting controls) or during non-peak periods (e.g. occupancy sensors). The peak demand calculations need to take into account the difference between the end-use loadshape and the measure energy savings load shape.

Criterion 5.6. Do peak demand savings incorporate energy savings load shapes appropriately?

1 – No.

2 – Yes.

### 5.7 Consistency with Total Utility Energy Sales

In any bottom up model, it is necessary to keep sight of the big picture. All of the underlying assumptions about energy use, saturations, building stock, etc., should be consistent with a utility's overall energy sales. While it sounds obvious, an analyst may "fail to see the forest for the trees" when spending so much time working at a disaggregated level. Energy use for the various end use and building type combinations analyzed should add up to total energy consumption.

Criterion 5.7. Do base energy usage estimates add up to total energy consumption?

1 – No.

2 – Yes.

### 5.8 Consistency with Baseline Energy Consumption

A similar error can result when savings are calculated independently of baseline energy (e.g. starting with kWh per unit rather than percent savings) without looping back to evaluate the savings in context. In this case, calculated savings may end up too high or too low relative to baseline energy. The reviewer should calculate the percent savings implied by the calculated savings and baseline energy. If the implied percent savings is out of line with what one would expect (based on the reviewer's experience with other potential studies), it may indicate that such an error has been made. The reviewer should investigate such occurrences.

Criterion 5.8. Are savings estimates consistent with overall baseline energy consumptions?

1 – No.

2 – Yes

### 5.9 Realistic Savings Percentages

For individual measures, savings may be input as a percent or as a level (such as kWh per unit). Percents are more forgiving, in that the savings will automatically scale with the energy use of

the base measure. If base refrigerator energy is 600 kWh per year per household, and savings are 10 percent, then the model will calculate savings at 60 kWh. If new data comes in, and it is found that refrigerator is 1000 kWh per household, the model will recalculate savings to be 100 kWh.

If, on the other hand, your model takes the input as a level, and you start with 600 kWh baseline energy and 60 kWh savings, when the new data comes in you must remember to change both the baseline energy and the energy savings. If you change the baseline energy but forget to change the savings, you now have baseline energy of 1000 kWh and savings of 60 kWh, for a savings of only 6 percent.

There is nothing inherently wrong with entering savings as a level, provided that the savings are (and remain) consistent with the baseline energy use. But because of the possibility of a disconnect, it is important to use this approach with caution.

Criterion 5.9. If savings are included as a level (e.g. kWh/unit), does the implied percent savings make sense?

1 – No.

2 – Yes.

3 – N/A

## 6. Measure Life Inputs

### 6.1 Measure Lifes from DEER

Measure life inputs are used to determine lifetime costs and savings and to perform stock accounting for replace-on-burnout measures.

We expect that the POUs will overwhelmingly use DEER measure life inputs for the majority of measures included in the potential studies. DEER is described in the discussion for question 4.1.

Criterion 6.1. Does the model use measure life inputs from DEER appropriately?

1 – No. There are significant problems with how DEER measure life inputs are used in the model.

2 – Partially. Most DEER measure life inputs seem to be used appropriately, but some appear to be misused.

3 – Yes. DEER measure life inputs are used appropriately

4 – DEER measure life inputs are not used

5 – Unknown. There is not enough information to assess whether measure life inputs are appropriate.

## 6.2 Measure Lives Not from DEER

Potential studies may include measures not included in DEER, necessitating that inputs be found from other sources. A utility may also find that some DEER inputs are inappropriate for some reason (e.g. local variation in hours of use can affect measure life). In the latter case, deviations from available DEER inputs should be documented. Reasonable measure lives will be assessed by an experienced reviewer, and generally should not exceed 20-30 years.

Criterion 6.2. For measure life inputs not from DEER, do the measure life inputs generally appear to be reasonable?

- 1 – No. There are significant problems with non-DEER measure life inputs.
- 2 – Partially. Most non-DEER measure life inputs seem reasonable, but some appear questionable.
- 3 – Yes. Non-DEER measure life inputs appear to be reasonable
- 4 – All measure life inputs are from DEER
- 5 – Unknown. There is not enough information to assess whether measure life inputs are appropriate.

## 6.3 Measure Lives for Early Replacement Measures

Sometimes a potential model will incorporate early retirement measures, such as a refrigerator recycling program. For these measures, the replaced equipment was neither new, nor was it failing. In these cases it is not appropriate to use the full measure life for new equipment, because the equipment being replaced would have needed to be replaced at its natural end of life. For example, a refrigerator has a typical useful life of 20 years. So a 15-year-old refrigerator recycled under the recycling program would have needed to be replaced or retired after 5 years, so 5 years would be the appropriate life for the recycling measure. While such programs may differ in their estimate of the typical age of a refrigerator being recycled (i.e. the precise value of the assumed life may differ between studies), failure to make any adjustment is clearly incorrect.

Criterion 6.3. If early replacement measures are included in the analysis, does the measure life take into account that the equipment would have eventually been replaced?

- 1 – No.
- 2 – Yes.

## 7. Measure Applicability and Implementation Inputs

### 7.1 Measure Applicability

One key input to estimating potential is applicability. What percent of homes have, say, air conditioning? What percent of commercial floorspace is typically lit by T12 fluorescent lamps? In other words, what percent of the building stock is eligible for the measure?

This may involve more than one input. For example, the KEMA model estimates three input factors: applicability, feasibility, and incomplete factor. In analyzing a high efficiency electric water heater, for example, the applicability is typically the percent of homes with electric water heating. Feasibility might take into account space limitations, if high efficiency units have a larger diameter due to more insulation. Finally, the incomplete factor takes into account what percent of homes don't already have a high-efficiency water heater.

Eligible building stock should represent a reasonable estimate of the opportunity for a given measure. The key point is not the actual mechanics, but whether the eligible building stock calculated from the inputs is an accurate representation of the opportunity for the measure.

Criterion 7.1. Are the measure savings being applied to an eligible building stock that is a reasonable estimate of the opportunity for the measure?

- 1 – No. The eligible building stock appears to be too high or too low for many measures.
- 2 – Partially. The eligible building stock appears in the right range for most measures, but appears to be too high or too low for a few measures.
- 3 – Yes. The eligible building stock appears to be in the right range for all measures.

## 7.2 Market Penetrations

Technical and economic potential assume 100 percent measure penetrations into the eligible building stock. Program potential needs to consider the size of the incentives offered, market barriers to each measure, cost effectiveness of each measure, customer awareness and other factors, in determining the actual percent market penetration. This can be done through modeling, using (for example) technology adoption curves. It can be done through expert judgment, or it can explicitly leverage the program experience of one or more utilities to predict program impacts.

Criterion 7.2a. Are the market penetrations differentiated by measure?

- 1 – No
- 2 – Yes

Criterion 7.2b. Are the market penetrations reasonable, whether developed through modeling or input based on expert judgment?

- 1 – No. Market penetrations for most measures seem unreasonably high or low.
- 2 – Partially. Market penetrations for some measures seem unreasonably high or low.
- 3 – Yes. Market penetrations seem to be in the right range for most measures.

### 7.3 Naturally Occurring Energy Savings

Even in the absence of efficiency programs, some customers would adopt energy efficiency measures. This is referred to as naturally-occurring energy efficiency. These customers may take advantage of the program, even though they would have invested in the energy-efficient measure without it. Although a utility may take steps to exclude such “free riders” from incentive programs, it is almost inevitable that some incentive payments are made for “savings” which would have occurred even in the absence of the program. In utility program parlance, “gross savings” are the savings for all participants, including free riders; “net savings” are the savings with free riders excluded.

Criterion 7.3. Does the model distinguish naturally occurring energy savings from free ridership?

- 1 – No, neither free ridership nor naturally occurring is accounted for.
- 2 – Naturally occurring is included, but not free ridership.
- 3 – Free ridership is included, but not naturally occurring.
- 4 – Both are included

### 7.4 Net-to-Gross Ratios

In calculating program achievable savings, it is not enough to calculate gross savings. A potential model should be able to calculate net savings. This may be done through something as simple as an assumed net-to-gross ratio, but more sophisticated approaches would look at naturally occurring as a function of a number of factors. These factors may include cost effectiveness, awareness, and nonmarket barriers. Programs often assume an ex ante net-to-gross ratio of 0.8, but impact evaluations have found that ratios are often significantly lower, depending on market awareness and barriers. The following question applies only if net-to-gross ratios are a model input (model outputs are addressed in the following section)

Criterion 7.4. If net-to-gross ratios are an input to the model, are the levels reasonable?

- 1 – Net to gross ratios are uniform across measures at a level which appears to be unreasonable and unconventional for many measures
- 2 – Net to gross ratios vary by measure, but appear to be unreasonable and unconventional for many measures
- 3 – Net to gross ratios are set to 0.8 for most or all measures (a value that is conventional but may be unreasonable for many measures based on recent program experience)
- 4 – Net to gross ratios are uniform across measures at a level that appears to be reasonable for most measures.
- 5 – Net to gross ratios vary by measure and appear to be reasonable for most measures.

6 – Net to gross ratios are not a model input.

## 8. Other Inputs

### 8.1 General Input Values

Models typically incorporate a number of general parameters that affect all end-uses and measures. These include economic parameters that affect financial calculations of savings over time.

Criterion 8.1. Please record the following general input values

Inflation Rate \_\_\_\_\_

Utility Discount Rate \_\_\_\_\_

Energy avoided cost in 2010-Summer on-peak (\$/kWh) \_\_\_\_\_

Externalities avoided cost in 2010-Summer on-peak (\$/kWh) \_\_\_\_\_

Demand avoided cost in 2010-Summer on-peak (\$/kW) \_\_\_\_\_

Energy avoided cost in 2020-Summer on-peak (\$/kWh) \_\_\_\_\_

Externalities avoided cost in 2020-Summer on-peak (\$/kWh) \_\_\_\_\_

Demand avoided cost in 2020-Summer on-peak (\$/kW) \_\_\_\_\_

Energy avoided cost in 2010-Summer off-peak (\$/kWh) \_\_\_\_\_

Externalities avoided cost in 2010-Summer off-peak (\$/kWh) \_\_\_\_\_

Demand avoided cost in 2010-Summer off-peak (\$/kW) \_\_\_\_\_

Energy avoided cost in 2020-Summer off-peak (\$/kWh) \_\_\_\_\_

Externalities avoided cost in 2020-Summer off-peak (\$/kWh) \_\_\_\_\_

Demand avoided cost in 2020-Summer off-peak (\$/kW) \_\_\_\_\_

Residential:

Customer Discount Rate \_\_\_\_\_

Line Loss Rate \_\_\_\_\_

Other (specify) \_\_\_\_\_

Commercial:

Customer Discount Rate\_\_\_\_\_

Line Loss Rate\_\_\_\_\_

Other (specify)\_\_\_\_\_

Industrial:

Customer Discount Rate\_\_\_\_\_

Line Loss Rate\_\_\_\_\_

Other (specify)\_\_\_\_\_

## 8.2 Discount Rates

Discount rates can be real or nominal, but they should be consistent with other financial inputs to the model. In particular, if the avoided costs and rates being used are real, discount rates should also be real. If the avoided costs and rates being used are nominal, discount rates should also be nominal. The analyst may choose to take a utility's forecast of real rates and escalate them at the inflation rate to maintain consistency, or the discount rates can be changed instead.

Criterion 8.2. Are discount rates presented on the same basis as avoided costs and energy and demand rates, that is, are they all real or all nominal?

- 1 – No. There is a mix of real and nominal inputs among these key financial inputs.
- 2 – Yes. All the discount rates and key financial inputs are real.
- 3 – Yes. All the discount rates and key financial inputs are nominal.

## 8.3 Building Decay and New Construction

When program costs and savings are evaluated over a defined program period (e.g. 10 years), a model should take into account the effect of both building decay and new construction. That is, old buildings are torn down (or gutted and fully renovated) and new ones are built. The overall effect of the building decay and new construction rates should result in an overall net building stock that is consistent with the utility's load forecasts over the forecast period. The CalEERAM model includes utility energy and demand forecasts that can be used for comparison.

Criterion 8.3. Are existing building decay rate and the rate of new construction calibrated to load forecasts?

- 1 – No. Building growth/decay are not calibrated to load forecasts.
- 2 – Partially. An attempt was made to calibrate to load forecasts, but the resulting building forecast does not yield the desired result.
- 3 – Yes. Building growth/decay are properly calibrated to load forecasts.

4 – Unknown. It could not be determined whether building growth/decay are properly calibrated to load forecasts.

## 9. Multiple Fuel Types and Interactive Effects

Measures sometimes save energy from multiple fuel sources. For example, insulated ducts could save both natural gas and electricity by decreasing heating and air conditioning loads, respectively.

### 9.1 Measure Cost Allocation

For utilities that run both gas and electric programs, it is usually a clear choice to somehow allocate costs between the two fuels to reflect the allocation of savings between the fuels. This is more challenging than it sounds, since gas and electric studies are typically not done concurrently or interactively (even when funded under the same contract). There are multiple possible ways to accomplish this allocation. One is to pro-rate costs between the two fuels in proportion to savings, or in a way that makes the measure cost effective for both fuel types (if the measure is cost effective taken as a whole). Another way is to account for the savings from the “other” fuel as a negative operations and maintenance cost. For example, in an electric study, the gas savings for duct insulation would be represented as the net present value of the dollar value of gas savings over the life of the duct insulation. Those savings would then be subtracted from the total measure cost to represent the real cost to achieve the electric savings.

Utilities that only run electric programs or that only run gas programs sometimes want to allocate the full measure cost to the fuel that they provide. If this is done, the participant benefits are understated, but the utility benefits are correct.

Criterion 9.1. For measures which save energy from multiple fuel sources, are cost inputs apportioned or benefits in other fuel savings accounted for correctly?

1 – No. The inputs do not seem to address this issue and the issue is not acknowledged or discussed.

2 – No. The inputs do not seem to address this issue but the issue is acknowledged and the decision not to apportion or adjust costs is explained.

3 – Yes. The calculations were performed outside of the model and factored into the cost inputs.

4 – Yes. The model endogenously accounts for this.

### 9.2 Measure Savings Allocation

Measures that save energy from multiple fuel sources may save a disproportionate amount of energy from one fuel. Data sources on savings may report average savings over all fuels, or savings from the wrong fuel type could be mistakenly applied.

Criterion 9.2. For measures which save energy from multiple fuel sources, are savings inputs appropriate to the fuel being analyzed?

- 1 – No. The savings appear to be for the wrong fuel or average over all fuels.
- 2 – Yes. The savings values appear to be correct for the fuel being analyzed.

### 9.3 Interactive Effects

Occasionally, an efficiency measure will have interactive effects across multiple end uses. For example, incandescent light bulbs give off far more waste heat than LED or CFL bulbs, so replacing significant numbers of incandescents for either CFLs or LEDs will measurably lessen the building's summer cooling load and increase the winter heating load. This effect will thus diminish the savings potential of air conditioning measures and increase the potential savings from heating measures. Similarly, shell measures reducing a building's solar heat gain (window film, cool roofs) reduce cooling loads but increase heating loads.

Criterion 9.3. Are interactive effects accounted for?

- 1 – Partially. Interactive effects are included asymmetrically, for example by including cooling benefits but not heating penalties.
- 2 – No.
- 3 – Partially. Interactive effects are approximated through calculations done outside the model, and input in some fashion.
- 4 – Partially. Interactive effects are addressed for some measures but not others.
- 5 – Yes. The model fully accounts for interactive effects by using differential equations

### 9.4 Bundled Measures

If measures are bundled together in innovative service offerings, it is possible to save on labor and transaction costs. For example, whole house residential retrofits are a "one-stop-shop" approach that install multiple efficiency measures on a single visit, thereby lessening time spent in transit or negotiating with the customer. While the same level of savings could be achieved in multiple visits, the overall cost of the efficiency measures would be higher. This makes it a very efficient delivery vehicle for deep energy savings.

Criterion 9.4. Are bundled measures and the associated cost decreases considered?

- 1 – No.
- 2 – Yes. Describe: \_\_\_\_\_

## 10. Outputs

Program potential takes into account stock turnover and market penetration over time. The outputs should include program costs and savings over a number of years, based on the length of the study. Year 5 is selected to compare the model outputs across sectors, since some models may need a few years into the future for program assumptions to stabilize. For instance, new

programs need time to ramp up, and to allow for new construction and building decay assumptions to propagate through the model across a number of years into the future.

The following table should be filled in with model outputs for year 5 of the program analysis.

**Program Potential Model Outputs for Year 5 of Program**

Sector:	Sector 1	Sector 2	Sector 3
Energy savings in year 5 (kWh)			
Demand savings in year 5 (MW)			
Total program costs in year 5 (\$)			
Incentive costs in year 5 (\$)			
Administrative costs in year 5 (\$)			
Marketing costs in year 5 (\$)			
Administrative costs as a percent of total program costs (year 5)			
Marketing costs as a percent of total program costs (year 5)			
TRC in year 5			
Does the cost effectiveness calculation include program admin costs?	Y / N	Y / N	Y / N
Overall net-to-gross-ratio in year 5			
Program cost per unit of savings (\$/kWh)			

### 10.1 Program Ramp-Up Output

When calculating program potential, the program increases in size over time as customer awareness of the program and participation increase. Factors determining ramp-up might include marketing budgets and incentive levels. Higher incentive levels attract more participants and tend to increase awareness faster than lower incentives. A higher marketing budget would increase awareness.

Criterion 10.1. Is the rate of program ramp-up reasonable for budget and savings?

1 – No. The program ramps up very rapidly at a rate not accounted for by high incentives or marketing budgets.

2 – No. The program ramps up very slowly at a rate not accounted for by high incentives or marketing budgets.

3 – Yes. The program ramp-up seems reasonable given marketing budgets and incentive levels.

## 10.2 Program Cost per Unit Savings Output

The model should calculate (or it should be possible to calculate from the model outputs) the total program cost per unit of annual savings. This is a metric of how much the program is paying for savings. An extremely low number might suggest that the utility is not being sufficiently aggressive in pursuing savings opportunities. Too high a number might call into question the overall cost effectiveness of the program.

One would expect the cost per unit of savings to relate to rates in a way similar to payback. If the applicable electric rate was 10 cents per kWh, and the program cost per annual kWh saved was \$1, it takes 10 years of savings for the program to recoup the program costs. That is at the high outside end of what a program might consider to be feasible. On the other end, if the cost was 10 cents per annual kWh saved, the “payback” would only be 1 year. At that level, the program might be considering only extremely cost effective measures that the market might take care of on its own. The range of reasonable values depends on the utility energy rate, which depends on the sector, the utility and the fuel.

Criterion 10.2. Are total program costs per unit of savings reasonable in relation to recent history and cost-savings relationships seen at the other POU and California IOUs?

1 – No. Program costs per unit of savings are significantly higher than found in other studies.

2 – No. Program costs per unit of savings are significantly lower than found in other studies.

3 – Yes.

## 11. Consistency with other studies

### 11.1 Measure Input Consistency

The following questions address whether the model inputs used for this study are reasonably consistent with other potential studies, especially the other California POU studies. The goal is to identify areas where there is a large discrepancy that may require additional explanation, or may indicate that an error was made.

Criterion 11.1a. Are the measures inputs reasonably consistent with those of other POU studies?

1 – No. Many measure inputs differ significantly from the normal range

2 – Partially. Many measure inputs differ somewhat from the normal range

3 – Partially. A few measure inputs differ significantly from the normal range

4 – Yes. Most measure inputs fall in the normal range, with only a few small differences.

Criterion 11.1b. Are the end-use level inputs reasonably consistent with those of other POU studies?

1 – No. Many measure inputs differ significantly from the normal range

2 – Partially. Many measure inputs differ somewhat from the normal range

3 – Partially. A few measure inputs differ significantly from the normal range

4 – Yes. Most measure inputs fall in the normal range, with only a few small differences.

Criterion 11.1c. Are the general inputs discussed above (inflation rate, utility discount rate, consumer discount rate, line loss rate) reasonable consistent with those of other POU studies?

1 – No. Two or more general inputs differ significantly from the normal range

Specify which inputs \_\_\_\_\_

2 – Partially. One of the general inputs differs significantly from the normal range

Specify which inputs \_\_\_\_\_

3 – Yes. All general inputs fall in the normal range

## 11.2 Avoided Cost Consistency

Measure cost-effectiveness is based in part on utilities' avoided costs. Avoided cost can be thought of as the marginal cost for a public utility to produce one more unit of power. These costs determine the benefit to the utility of energy efficiency. Each unit of energy saved due to energy efficiency saves the utility the cost of producing or purchasing that unit—the avoided cost. While rates differ by sector, avoided costs are the same.

Criterion 11.2. Are the avoided cost assumptions consistent with those of other POU studies?

1 – No. Avoided costs differ significantly from the normal range

2 – Partially. Avoided costs differ somewhat from the normal range

3 – Yes. Avoided costs fall in the normal range

## 11.3 Alternate Scenario Consistency

A potential study may evaluate alternative scenarios. These can include different incentive levels (e.g. 50%, 75% and 100% of incremental costs) or different avoided cost scenarios. In comparing studies, it is important to be able to compare forecasts based on similar assumptions.

Criterion 11.3. Are the scenarios consistent with those of other POU studies?

- 1 – No. Avoided costs differ significantly from the normal range
- 2 – Partially. Avoided costs differ somewhat from the normal range
- 3 – Yes. Avoided costs fall in the normal range

## 12. Consistency with Previous Potential Estimates and Targets

One goal of this study is to compare the 2010 targets to the 2007 targets. Tables 1 through 6 should be filled in from the 2007 AB2021 report and the 2010 AB1037 report, or from the 2010 CalEERAM models. We expect that these data will be entered into a spreadsheet electronically for all utilities, rather than by the analyst reviewing the individual potential study.

Savings may be reported as annual, that is, for units installed by the program in a given year, or cumulative, which include the savings for units installed by the program in previous years. There is often confusion over the terms, since cumulative savings are not, as one might think, the program savings summed over a number of years. It is the savings in a particular year for units installed due to the program in prior years that are still in service and saving energy. The AB2021 report appeared to report cumulative savings, while the SB1037 report seemed to report annual, which could lead to false comparisons between the values. The tables below therefore include a column to calculate the annual energy reduction target for the 2007 forecast to allow comparisons between the two studies.

## Comparison of 2007 and 2010 Energy Savings Potentials and Targets (MWh)

**Table B-1, Table B-2, and Table B-3** compare estimated potentials and targets for energy savings (MWh), first for all sectors, and then by residential and non-residential sectors.

**Table B-1: Comparison of 2007 and 2010 Energy Potentials and Targets—All Sectors**

	2007 Forecast					2010 Forecast				
	Baseline Energy Forecast (MWh)	Technical Energy Efficiency Potential (MWh)	Cost- Effective Energy Efficiency Potential (MWh)	Cumulativ e Energy Reduction Target (MWh)	Annual Energy Reduction Target (MWh) calculated	Baseline Energy Forecast (MWh)	Technical Potential (MWh)	Economic Potential (MWh)	Market Potential (MWh)	Annual Energy Reduction Target (MWh)
2007										
2008										
2009										
2010										
2011										
2012										
2013										
2014										
2015										
2016										
2017										
2018										
2019										
2020										
10-Year Total										

The AB 2021 report provides baseline forecasts only at the utility level, not for specific sectors, so **Table B-2** and **Table B-3** omit baseline energy for the 2007 study.

**Table B-2: Comparison of 2007 and 2010 Energy Potentials and Targets—Residential Sector**

	2007 Forecast				2010 Forecast				
	Technical Energy Efficiency Potential (MWh)	Cost-Effective Energy Efficiency Potential (MWh)	Cumulative Energy Reduction Target (MWh)	Annual Energy Reduction Target (MWh) calculated	Baseline Energy Forecast (MWh)	Technical Potential (MWh)	Economic Potential (MWh)	Market Potential (MWh)	Annual Energy Reduction Target (MWh)
2007									
2008									
2009									
2010									
2011									
2012									
2013									
2014									
2015									
2016									
2017									
2018									
2019									
2020									
10-Year Total									

**Table B-3: Comparison of 2007 and 2010 Efficiency Potentials and Targets—Nonresidential Sector**

	2007 Forecast				2010 Forecast				
	Technical Energy Efficiency Potential (MWh)	Cost- Effective Energy Efficiency Potential (MWh)	Cumulative Energy Reduction Target (MWh)	Annual Energy Reduction Target (MWh) calculated	Baseline Energy Forecast (MWh)	Technical Potential (MWh)	Economic Potential (MWh)	Market Potential (MWh)	Annual Energy Reduction Target (MWh)
2007									
2008									
2009									
2010									
2011									
2012									
2013									
2014									
2015									
2016									
2017									
2018									
2019									
2020									
10-Year Total									

## Comparison of 2007 and 2010 Demand Savings Potentials and Targets (MW)

Table B-4, Table B-5, and Table B-6 compare estimated potentials and targets for demand savings (MW), first for all sectors, and then by residential and non-residential sectors.

**Table B-4: Comparison of 2007 and 2010 Demand Potentials and Targets—All Sectors**

	2007 Forecast					2010 Forecast				
	Baseline Demand Forecast (MW)	Technical Energy Efficiency Potential (MW)	Cost-Effective Energy Efficiency Potential (MW)	Cumulative Demand Reduction Target (MW)	Annual Demand Reduction Target (MW) calculated	Baseline Demand Forecast (MW)	Technical Potential (MW)	Economic Potential (MW)	Market Potential (MW)	Annual Demand Reduction Target (MW)
2007										
2008										
2009										
2010										
2011										
2012										
2013										
2014										
2015										
2016										
2017										
2018										
2019										
2020										
10 Year Total										

The AB 2021 report provides baseline forecasts only at the utility level, not for specific sectors. Utility demand forecasts are provided only at the utility level, not the sector, so baseline demand is not presented in **Table B-5** or **Table B-6**.

**Table B-5: Comparison of 2007 and 2010 Demand Potentials and Targets—Residential Sector**

	2007 Forecast				2010 Forecast			
	Technical Energy Efficiency Potential (MW)	Cost-Effective Energy Efficiency Potential (MW)	Cumulative Energy Reduction Target (MW)	Annual Demand Reduction Target (MW) calculated	Technical Potential (MW)	Economic Potential (MW)	Market Potential (MW)	Annual Energy Reduction Target (MW)
2007								
2008								
2009								
2010								
2011								
2012								
2013								
2014								
2015								
2016								
2017								
2018								
2019								
2020								
10-Year Total								

**Table B-6: Comparison of 2007 and 2010 Demand Potentials and Targets—Nonresidential Sector**

	2007 Forecast				2010 Forecast			
	Technical Energy Efficiency Potential (MW)	Cost- Effective Energy Efficiency Potential (MW)	Cumulative Energy Reduction Target (MW)	Annual Energy Reduction Target (MW) calculated	Technical Potential (MW)	Economic Potential (MW)	Market Potential (MW)	Annual Energy Reduction Target (MW)
2007								
2008								
2009								
2010								
2011								
2012								
2013								
2014								
2015								
2016								
2017								
2018								
2019								
2020								
10-Year Total								



## APPENDIX C: Model Inputs

**Table C-1** shows key inputs to the CalEERAM model by utility. Yellow highlighting indicates where an input differs from the majority of other utilities; green indicates inputs that were highly variable across utilities.

**Table C-1: Comparison of Key Model Inputs by Utility**

	Anaheim	Banning	Burbank	Glendale	Imperial	Modesto	Palo Alto	Pasadena	Riverside	Roseville	SVP	Truckee	Turlock
Residential Decision Curve Beta Value	2	2	2	2	2	2	2	2	2	2	2	2	2
Residential Will & aware inflection--Lighting	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	10	3.5	3.5	3.5
Residential Will & aware inflection--Water heating	5	5	5	5	5	5	5	5	5	10	5	5	5
Residential Will & aware inflection--Appliances	5	5	5	5	5	5	5	5	5	4	5	5	5
Residential Will & aware inflection--HVAC/Shell	5	5	5	5	5	5	5	5	5	6	5	5	5
Residential Calibration target %	0.012	0.007	0.012	0.0096	0.011	0.003	0.0095	0.012	0.006	0.005	0.006	0.009	0.0025
Residential Base case incentive--lighting	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.001	0.5	0.5	0.5
Residential Base case incentive--water heating	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.001	0.5	0.5	0.5
Residential Base case incentive--Appliances	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.15	0.5	0.5	1
Residential Base case incentive--HVAC/shell	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.1	0.5	0.5	0.5
Residential Scenario incentive--lighting	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0	0.5	0.25	0.5

	Anaheim	Banning	Burbank	Glendale	Imperial	Modesto	Palo Alto	Pasadena	Riverside	Roseville	SVP	Truckee	Turlock
Residential Scenario incentive--water heating	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0	0.5	0.5	0.5
Residential Scenario incentive--Appliances	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.15	0.5	0.25	1
Residential Scenario incentive--HVAC/shell	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.1	0.5	0.25	0.5
Commercial Decision Curve Beta Value	2	2	2	2	2	2	2	2	2	2	2	2	2
Commercial Will & aware inflection--Lighting	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	6	3.5	3.5	3.5
Commercial Will & aware inflection--Water heating	5	5	5	5	5	5	5	5	5	10	5	5	5
Commercial Will & aware inflection--Appliances	5	5	5	5	5	5	5	5	5	3	5	5	5
Commercial Will & aware inflection--HVAC/Shell	5	5	5	5	5	5	5	5	5	3	5	5	5
Commercial Calibration target %	0.005	0.038913	0.0075	0.0096	0.0075	0.0096	0.0045	0.0096	0.008	0.009	0.0096	0.013039	0.0096
Commercial Base case incentive--lighting	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.723	0.5	0.5	0.5
Commercial Base case incentive--water heating	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.005	0.5	0.5	0.5
Commercial Base case incentive--Appliances	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.25	0.5	0.5	0.5
Commercial Base case incentive--HVAC/shell	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.1	0.5	0.5	0.5
Commercial Scenario incentive--lighting	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.75	0.5	0.5	0.5
Commercial Scenario incentive--water heating	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.005	0.5	0.5	0.5
Commercial Scenario	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.25	0.5	0.5	0.5

	Anaheim	Banning	Burbank	Glendale	Imperial	Modesto	Palo Alto	Pasadena	Riverside	Roseville	SVP	Truckee	Turlock
incentive--Appliances													
Commercial Scenario incentive--HVAC/shell	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.1	0.5	0.5	0.5
Res elec rate 2011 average	0.09	0.23	0.14	0.14	0.08	0.14	0.14	0.14	0.11	0.13	0.09	0.19	0.14
Res elec rate 2020 average	0.11	0.22	0.18	0.14	0.1	0.16	0.22	0.22	0.13	0.14	0.11	0.18	0.17
Res demand rate 2011 summer	0	0	0	0	0	0	0	0	0	0	0	0	0
Res demand rate 2020 summer	0	0	0	0	0	0	0	0	0	0	0	0	0
Non-res elec rate 2011 average	0.13	0.19	0.15	0.13	0.09	0.11	0.13	0.08	0.14	0.1	0.14	0.1	0.12
Non-res elec rate 2020 average	0.16	0.23	0.19	0.13	0.11	0.13	0.21	0.1	0.17	0.1	0.17	0.13	0.15
Non-res demand rate 2011 summer	0	0	0	0	0	0	0	0	11.19	5.52	0	0	0
Non-res demand rate 2020 summer	0	0	0	0	0	0	0	0	13.61	6.43	0	0	0
Avoided costs-- Energy 2011 summer on	0.14	0.14	0.14	0.14	0.14	0.14	0.09	0.14	0.14	0.14	0.14	0.14	0.11
Avoided costs-- Energy 2011 summer off	0.08	0.08	0.08	0.08	0.08	0.08	0.06	0.08	0.08	0.08	0.08	0.08	0.07
Avoided costs-- Energy 2011 winter on	0.1	0.1	0.1	0.1	0.1	0.1	0.09	0.1	0.1	0.1	0.1	0.1	0.09
Avoided costs-- Energy 2011 winter off	0.08	0.08	0.08	0.08	0.08	0.08	0.07	0.08	0.08	0.08	0.08	0.08	0.07
Avoided costs-- Energy 2020 summer on	0.15	0.15	0.15	0.15	0.15	0.15	0.14	0.15	0.15	0.15	0.15	0.15	0.16
Avoided costs-- Energy 2020 summer off	0.08	0.08	0.08	0.08	0.08	0.08	0.1	0.08	0.08	0.08	0.08	0.08	0.1
Avoided costs-- Energy 2020 winter on	0.11	0.11	0.11	0.11	0.11	0.11	0.14	0.11	0.11	0.11	0.11	0.11	0.13

	Anaheim	Banning	Burbank	Glendale	Imperial	Modesto	Palo Alto	Pasadena	Riverside	Roseville	SVP	Truckee	Turlock
Avoided costs-- Energy 2020 winter off	0.09	0.09	0.09	0.09	0.09	0.09	0.11	0.09	0.09	0.09	0.09	0.09	0.1
Avoided costs-- Externalities 2011 summer on	0	0	0	0	0	0	0	0	0	0	0	0	0
Avoided costs-- Externalities 2011 summer off	0	0	0	0	0	0	0	0	0	0	0	0	0
Avoided costs-- Externalities 2011 winter on	0	0	0	0	0	0	0	0	0	0	0	0	0
Avoided costs-- Externalities 2011 winter off	0	0	0	0	0	0	0	0	0	0	0	0	0
Avoided costs-- Externalities 2020 summer on	0	0	0	0	0	0	0	0	0	0	0	0	0
Avoided costs-- Externalities 2020 summer off	0	0	0	0	0	0	0	0	0	0	0	0	0
Avoided costs-- Externalities 2020 winter on	0	0	0	0	0	0	0	0	0	0	0	0	0
Avoided costs-- Externalities 2020 winter off	0	0	0	0	0	0	0	0	0	0	0	0	0
Avoided costs-- Demand 2011 summer on	0	0	0	0	0	0	0	0	0	0	0	0	0
Avoided costs-- Demand 2011 summer off	0	0	0	0	0	0	0	0	0	0	0	0	0
Avoided costs-- Demand 2011 winter on	0	0	0	0	0	0	0	0	0	0	0	0	0
Avoided costs-- Demand 2011 winter off	0	0	0	0	0	0	0	0	0	0	0	0	0
Avoided costs-- Demand 2020	0	0	0	0	0	0	0	0	0	0	0	0	0

	Anaheim	Banning	Burbank	Glendale	Imperial	Modesto	Palo Alto	Pasadena	Riverside	Roseville	SVP	Truckee	Turlock
summer on													
Avoided costs-- Demand 2020 summer off	0	0	0	0	0	0	0	0	0	0	0	0	0
Avoided costs-- Demand 2020 winter on	0	0	0	0	0	0	0	0	0	0	0	0	0
Avoided costs-- Demand 2020 winter off	0	0	0	0	0	0	0	0	0	0	0	0	0
Inflation rate	0.022	0.022	0.022	0.022	0.022	0.022	0.022	0.022	0.022	0.022	0.022	0.022	0.022
Utility Discount Rate	0.045	0.045	0.045	0.045	0.045	0.045	0.045	0.045	0.045	0.045	0.045	0.045	0.045
Line Loss Rate	0.0320	0.0369	0.0369	0.0369	0.0369	0.0369	0.0450	0.0369	0.0503	0.0369	0.0369	0.0369	0.0369
Admin costs--Res-- Lighting	0.07	0.07	0.07	0.07	0.07	0.07	0.14	0.07	0.07	0.07	0.07	0.07	0.03
Admin costs--Res-- water heat	0.07	0.07	0.07	0.07	0.07	0.07	0.14	0.07	0.07	0.07	0.07	0.07	0.06
Admin costs--Res-- appliances	0.07	0.07	0.07	0.07	0.07	0.07	0.14	0.07	0.07	0.07	0.07	0.07	0.06
Admin costs--Res-- HVAC/shell	0.07	0.07	0.07	0.07	0.07	0.07	0.14	0.07	0.07	0.07	0.07	0.07	0.06
Admin costs--Non- Res--Lighting	0.06	0.06	0.06	0.06	0.06	0.06	0.09	0.06	0.06	0.06	0.06	0.06	0.05
Admin costs--Non- Res--Water heat	0.06	0.06	0.06	0.06	0.06	0.06	0.09	0.06	0.06	0.06	0.06	0.06	0.06
Admin costs--Non- Res--Refrigeration	0.06	0.06	0.06	0.06	0.06	0.06	0.09	0.06	0.06	0.06	0.06	0.06	0.06
Admin costs--Non- Res--HVAC shell	0.06	0.06	0.06	0.06	0.06	0.06	0.09	0.06	0.06	0.06	0.06	0.06	0.06
Admin costs--Non- Res--Other	0.06	0.06	0.06	0.06	0.06	0.06	0.09	0.06	0.06	0.06	0.06	0.06	0.06



